PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-002812
(43)Date of publication of application : 06.01.1999

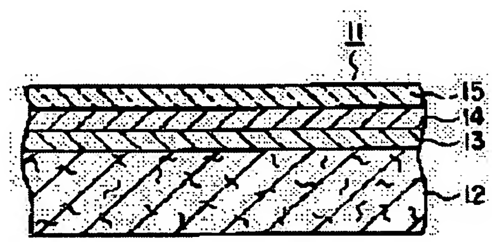
(51)Int.Cl. G02F 1/1335
G02F 1/1343
G09F 9/30

(21)Application number : 09-155456
(22)Date of filing : 12.06.1997

(71)Applicant : TOSHIBA CORP
(72)Inventor : KAJIURA SADAO

(54) REFLECTION CONDUCTIVE SUBSTRATE, REFLECTION LIQUID CRYSTAL DISPLAY DEVICE, AND MANUFACTURE OF REFLECTION CONDUCTIVE SUBSTRATE

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain the reflection conductive substrate which is lightweight and has high heat resistance and rigidity by laminating a reflection layer which contains white pigment and resin, a barrier layer formed of silica, and a conductive layer in order on a laminate plate formed of fiber cloth set with resin.
SOLUTION: The reflection conductive substrate 11 is constituted by laminating the reflection layer 13 containing the white pigment and resin, the barrier layer 14 formed of silica, and the conductive layer 15 in order on one main surface of the laminate plate 12 formed of the fiber cloth impregnated with thermosetting resin. The silica constituting the barrier layer 14 is produced preferably from polysilazane having a cyclic structure. Further, the reflection layer 13 and barrier layer 14 may be formed on both the surfaces of the laminate plate 12. As the material of the fiber cloth used for the laminate plate 12, there are glass such as E glass, D glass, and S glass and a filament of resin such as aromat c polyamide. The laminate plate 12 is preferably of double stack constitution from the point of view of weight reduction.



CLAIMS

[Claim(s)]
[Claim 1] The reflective mold conductivity substrate characterized by providing the laminate containing the fiber cloth which resin was infiltrated and was stiffened, the reflecting layer formed on said laminate including white pigments and resin, the barrier layer formed on said reflecting layer including the silica, and the conductive layer formed on said barrier layer.
[Claim 2] The reflective mold conductivity substrate according to claim 1 characterized by generating the silica which constitutes said barrier layer from the polysilazane which has cyclic structure.
[Claim 3] The reflective mold conductivity substrate according to claim 1 or 2 with which said reflecting layer and a barrier layer are characterized by being formed in both sides of said laminate.
[Claim 4] The laminate containing the fiber cloth which resin was infiltrated and was stiffened, and the reflecting layer formed on said laminate including white pigments and resin, The reflective mold conductivity substrate equipped with the barrier layer formed on said reflecting layer including the silica, and the conductive layer formed on said barrier layer, The reflective mold liquid crystal display characterized by providing the liquid crystal layer prepared between the transparence resin substrate with which it countered with the field in which the conductive layer of said reflective mold conductivity substrate was formed, and was prepared, and the transparent electrode was formed in the opposed face, and said reflective mold conductivity substrate and a transparence resin substrate.
[Claim 5] The manufacture approach of the reflective mold conductivity substrate characterized by to provide the process which forms the barrier layer which contains a silica the process which applies and heats the mixture of white pigments and thermosetting resin, and forms a reflecting layer in one principal plane of the laminate which the fiber cloth was made into the core material, and resin was infiltrated, and was stiffened, and by applying and heat-treating the polysilazane which has cyclic structure on said reflecting layer, and the process which form a conductive layer on said barrier layer.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the manufacture approach of a reflective mold conductivity substrate, a reflective mold liquid crystal display, and a reflective mold conductivity substrate, and relates to the manufacture approach of the reflective mold conductivity substrate suitable for the liquid crystal display especially carried in a Personal Digital Assistant device, a reflective mold liquid crystal display, and a reflective mold conductivity substrate.
[0002]
[Description of the Prior Art] In recent years, the need of a small Personal Digital Assistant device is increasing with progress of satellite communication or migration communication technology. The display carried in many of Personal Digital Assistant devices is asked for it being a thin shape, and the liquid crystal display is most used abundantly.
[0003] Moreover, since it is required for the display for Personal Digital Assistant devices that it is a low power and that the visibility under outdoor daylight should be high, the reflective mold liquid crystal display is used abundantly rather than the transparency mold liquid crystal display.
[0004] One sectional view of the conventional reflective mold liquid crystal display is shown in drawing 4 . The liquid crystal layer 44 prepared between the conductive substrates 42 and 43 of a pair with which the reflective mold liquid crystal display 41 has been arranged face to face, and the electrode layer was formed in each opposed face by drawing 4 , and which consist of glass, and the conductive substrates 42 and 43 of these pairs, and the liquid crystal layer of the conductive substrate 42 consist of light reflex layers 45 which consist of mixture of the white pigments and PET which were prepared in the field of the opposite side etc.
[0005] Thus, the light reflex layer 45 is formed instead of the back light generally used for a reflective mold liquid crystal display with a transparency mold liquid crystal display. The conductive substrate used with an above-mentioned reflective mold liquid crystal display is a transparency mold conductivity substrate with which the conductive layer which consists of a transparent conductive ingredient was generally formed on the glass plate with a thickness of 0.7-1.1mm which has optical properties, such as the Takamitsu transmission, low Hayes, and a low retardation.
[0006] Since the glass plate which has thermal resistance and chemical resistance is used for this transparency mold conductivity substrate, it has sufficient reinforcement, for example to processing of the photo etching performed in processes in manufacture of a liquid crystal display, such as formation of the orientation film, and electrode formation, sputtering, etc.
[0007] Moreover, properties, such as oxygen barrier property required of a conductive substrate, steam barrier property, and scratch-proof nature, are also good. However, since glass is used for the above-mentioned transparency mold conductivity substrate, its shock resistance is low and is very heavy. Since shock resistance falls further when thickness of a glass plate is made thin, in order to lightweight-ize a substrate, lightweight-izing is difficult. Therefore, using resin films, such as plastics, for a conductive substrate is examined by the small Personal Digital Assistant device currently asked for high shock resistance and a lightweight thing.
[0008] One sectional view of the conductive substrate which used the conventional resin film for drawing 5 is shown. The laminating of the anchor coat layer 53 and the transparent electrode layer 54 is carried out to one principal plane of the heat-resistant transparence resin film 52 one by one, the laminating of the barrier layer 55 and the rebound ace court layer 56 is carried out one by one, and the conductive substrate 51 is constituted from drawing 5 by the principal plane of another side of the heat-resistant transparence resin film 52.
[0009] The conductive substrate using a resin film is lightweight, without being divided unlike a glass plate. However, single resin cannot be made to pay all the functions, such as oxygen barrier property, steam barrier property, and scratch-proof nature, generally. Therefore, in the conductive substrate 51 using a resin film, the barrier layer 55 which has oxygen barrier property and steam barrier property, and the rebound ace court layer 56 which has scratch-proof nature are needed.
[0010] Moreover, on the heat-resistant-resin film 52, the transparent electrode layer 54 cannot be formed directly. Therefore, it is necessary to form the anchor coat layer 53 between the heat-resistant-resin film 52 and the transparent electrode layer 54.
[0011] In addition, although the barrier layer 55 is the monolayer which has oxygen barrier property and steam barrier property, since it is very difficult to give oxygen barrier property and steam barrier property to single resin, the barrier layer 55 is usually constituted from drawing 5 by the two-layer structure which carried out the laminating of the layer which has oxygen barrier property, and the layer which has steam barrier property. However, generally, the resin which has steam barrier property has high surface energy, and its familiarity by other resin is low. Therefore, in order to paste up other resin on the resin which has steam barrier property, it is necessary to perform surface treatment.
[0012] Thus, in manufacture of the conductive substrate using a resin film, since it is necessary to carry out the laminating of a huge number of the resin layers and many processes are needed, the problem that a production process becomes complicated will be produced.
[0013] Moreover, a line coefficient of thermal expansion is large, since the conductive substrate using a resin film is formed by carrying out the laminating of two or more resin layers from which coefficient of thermal expansion differs, it is easy to produce the curvature of a substrate etc. in the case of a heating process, and thermal resistance, such as heat dimensional stability, is low [a substrate]. Furthermore, since this conductive substrate is deficient in rigidity, deformation of substrates, such as above-mentioned curvature and

bending, produces it easily.
[0014] Therefore, if both conductive substrates 62 and 63 of a pair are constituted from resin as shown in drawing 6 , the problem that the alignment of a substrate etc. becomes difficult will be produced in the case of manufacture of a liquid crystal display. Since a hotter process becomes ** when forming an array electrode, this problem becomes remarkable especially.
[0015] Moreover, if one conductive substrate 72 is constituted from glass among the conductive substrates 72 and 73 of a pair and the conductive substrate 73 of another side is constituted from resin as shown in drawing 7 , problems, such as alignment of an above-mentioned substrate, will not be produced. However, since glass is used, the problem that shock resistance is low and lightweight-ization becomes difficult is produced.
[0016]
[Problem(s) to be Solved by the Invention] As mentioned above, the configuration became complicated and the conductive substrate used with the conventional reflective mold liquid crystal display needed many processes for manufacture of a substrate, in order to obtain lightweight-izing and sufficient shock resistance, the oxygen barrier property, steam barrier property, and scratch-proof nature of a substrate. Moreover, since thermal resistance and rigidity were low, it was easy to produce deformation of curvature, bending, etc., and manufacture of a display etc. was difficult.
[0017] It is lightweight and has sufficient shock resistance, oxygen barrier property, steam barrier property, and scratch-proof nature, and a configuration is easy and this invention aims at a thin shape and offering the manufacture approach of a reflective mold conductivity substrate with high thermal resistance and rigidity, a reflective mold liquid crystal display, and a reflective mold conductivity substrate.
[0018]
[Means for Solving the Problem] This invention offers the reflective mold conductivity substrate characterized by providing the laminate containing the fiber cloth which resin was infiltrated and was stiffened, the reflecting layer formed on said laminate including white pigments and resin, the barrier layer formed on said reflecting layer including the silica, and the conductive layer formed on said barrier layer.
[0019] This invention is characterized by generating the silica which constitutes said barrier layer from the polysilazane which has cyclic structure in the above-mentioned reflective mold conductivity substrate. This invention is characterized by forming said reflecting layer and a barrier layer in both sides of said laminate in the above-mentioned reflective mold conductivity substrate.
[0020] Moreover, the laminate with which this invention contains the fiber cloth which infiltrated resin and stiffened it, The reflecting layer formed on said laminate including white pigments and resin, and the barrier layer formed on said reflecting layer including the silica, The reflective mold conductivity substrate equipped with the conductive layer formed on said barrier layer, The reflective mold liquid crystal display characterized by providing the liquid crystal layer prepared between the transparence resin substrate with which it countered with the field in which the conductive layer of said reflective mold conductivity substrate was formed, and was prepared, and the transparent electrode was formed in the opposed face, and said reflective mold conductivity substrate and a transparence resin substrate is offered.
[0021] Furthermore, the process which applies and heats the mixture of white pigments and thermosetting resin, and forms a reflecting layer in one principal plane of the laminate which this invention made the fiber cloth the core material, and resin was infiltrated, and was stiffened, The manufacture approach of the reflective mold conductivity substrate characterized by providing the process which forms the barrier layer containing a silica, and the process which forms a conductive layer on said barrier layer is offered by applying and heat-treating the polysilazane which has cyclic structure on said reflecting layer.
[0022]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained more to a detail, referring to a drawing. One sectional view of the reflective mold conductivity substrate applied to 1 operation gestalt of this invention at drawing 1 is shown.
[0023] The reflective mold conductivity substrate 11 carries out the laminating of the reflecting layer 13 which contains white pigments and resin in one principal plane of the laminate 12 which consists of a fiber cloth into which thermosetting resin was infiltrated, the barrier layer 14 which consists of a silica, and the conductive layer 15 one by one, and consists of drawing 1 .
[0024] Although the laminate used with the reflective mold conductivity substrate of this invention consists of a fiber cloth into which thermosetting resin was infiltrated, it can mention filaments, such as glass, such as E glass, D glass, and S glass, and resin, such as aromatic polyamide, as an ingredient of the fiber cloth used.
[0025] As for the path of this filament, it is desirable that it is 20 micrometers or less. using the filament of a diameter 20 micrometers or less -- a reflective mold conductivity substrate -- thin-shape-izing -- and it can lightweight-ize and the mechanical strength of a substrate can be raised.
[0026] although it can also use as a nonwoven fabric, without weaving when using these filaments as a fiber cloth -- a plain weave and Chu-tzu -- it is desirable to weave by weave, such as textile and twill, and to use as textile fabrics. Moreover, as for the thickness of a fiber cloth, it is desirable that it is 30-100 micrometers, and it is more desirable that it is 30-50 micrometers. the case where the thickness of a fiber cloth is in above-mentioned within the limits -- a reflective mold conductivity substrate -- thin-shape-izing -- and it can lightweight-ize and the mechanical strength of a substrate can be raised.
[0027] In addition, the surface roughness of the fiber cloth produced changes according to the weave of a filament. the case where a fiber cloth is produced using the same filament -- surface roughness -- twill and Chu-tzu -- although it becomes high in order of textile and a plain weave, a substrate front face can be graduated by forming a barrier layer by sufficient thickness.
[0028] Moreover, when producing a fiber cloth with a plain weave, sinking in to the fiber cloth of the below-mentioned resin becomes easy, and the manufacturing cost of a laminate can be reduced. Thermosetting resin sinks into the fiber cloth explained above. As resin used for sinking in to a fiber cloth, the heat-resistant high thermosetting resin of phenol resin-epoxy resin mixture, bismaleimide-triazine resin mixture, etc. can be mentioned. If the epoxy resin of a bisphenol mold is used as an epoxy resin, using phenol novolak resin as phenol resin, since high thermal resistance can be obtained, it is especially desirable.
[0029] Although what is guided from diamino diphenylmethane can be used as bismaleimide, that to which the phenyl group of diamino diphenylmethane is guided from the compound permuted by the alkyl group may be used. Moreover, triazine resin can be obtained by the demineralization acid reaction of bisphenol A and a cyanogen chloride. In addition, what is marketed from the Mitsubishi engineering plastics company as such bismaleido triazine resin mixture as BT resin by which the epoxy resin etc. was added can be used.
[0030] As the laminate used with the reflective mold conductivity substrate of this invention is shown below, it is manufactured. First,

an above-mentioned thermosetting resin constituent is melted to organic solvents, such as ketone solvent, and the above-mentioned fiber cloth is infiltrated. This is dried primarily, and prepreg is produced and formed into B stage. It is 20-60kg/cm2, heating this prepreg at about 150-180 degrees C using for example, a two-sheet pile and a hotpress. It pressurizes by the pressure of extent. Furthermore, a laminate is obtained by heating this at about 150-180 degrees C, and stiffening thermosetting resin. As for the rate of the resinous principle in a laminate, it is desirable to be controlled to 40 - 60% of the weight.

[0031] Although the laminate manufactured as mentioned above is the configuration of having piled up two fiber cloths, it is a light weight and a thin shape, and if sufficient mechanical strength can be obtained, there will be especially no limit in the number of laminatings. However, in order to control the anisotropy of a laminate, as for a laminate, it is desirable to consider as the configuration which piled up even fiber cloths, and it is most desirable to consider as the configuration repeated two sheets from a viewpoint of lightweight-izing.

[0032] As for the thickness of this laminate, it is desirable that it is 50-200 micrometers, and it is more desirable that it is 50-100 micrometers. the case where the thickness of a laminate is in above-mentioned within the limits — a reflective mold conductivity substrate — thin-shape-izing — and it can lightweight-ize and the mechanical strength of a substrate can be raised.

[0033] Moreover, the laminate which is marketed from the laminate manufacturer and with which the metallic foil was stretched on the front face may be used as a laminate used with the reflective mold conductivity substrate of this invention. In addition, the metallic foil stretched by such laminate marketed is easily removable by etching.

[0034] With the reflective mold conductivity substrate of this invention, white pigments like a titania generally used can be mentioned as white pigments used for a reflecting layer. A reflecting layer is formed by making the thermosetting silicone resin distributed in the BTX solvent distribute these white pigments, applying and drying and heating this further to a laminate.

[0035] At this time, as for the weight ratio (P/R ratio) of white pigments to silicone resin, it is desirable that it is 2.5-6, and it is more desirable that it is 4-6. When a P/R ratio is more than the above-mentioned lower limit, the line coefficient of thermal expansion of each class which constitutes a reflective mold conductivity substrate can be made low, and the heat dimensional stability of a substrate can be raised. However, if a P/R ratio exceeds the above-mentioned upper limit, distribution of white pigments will become difficult.

[0036] As for the thickness of this reflecting layer, it is desirable that it is 5-10 micrometers. Without making the thickness and weight of a reflective mold conductivity substrate increase greatly, when the thickness of a reflecting layer is within the limits of this, it can be white, and the color of a laminate can be concealed, and until can reduce surface roughness to some extent.

[0037] The barrier layer of the reflective mold conductivity substrate of this invention can consist of silicas. As for the silica which constitutes this barrier layer, obtaining from polysilazane is desirable. Polysilazane is general formula H3 Si(NHSiH2) n NHSiH3. The silazane and general formula n (SiH2 NH) of the shape of a shown straight chain It is the polymer which makes a frame the shown cyclo silazane. If these polysilazane is carried out hydrolysis and a polycondensation by predetermined processing, Si-N association of polysilazane will be severed, Si-O association will be produced, and a silica and ammonia will be produced. Therefore, when it has the hydrogen atom which polysilazane combines with a silicon atom, the hydrogen atom combined with a silicon atom remains also in the silica to generate.

[0038] If the polysilazane of the low-temperature baking mold which has cyclic structures, such as annular par hydronalium polysilazane by which Pd complexes, such as TONEN polysilazane low-temperature baking mold N-L110 type marketed from TONEN CORP., were added as a catalyst as polysilazane, is used, since polysilazane is changeable into a silica by heating at the comparatively low temperature of about 100-150 degrees C, it is desirable.

[0039] If the polysilazane which has condensed-ring structure is used as polysilazane of the low-temperature baking mold which has cyclic structure especially, the rate of the hydrogen atom combined with a silicon atom decreases in the silica which is a resultant, and since the number of the oxygen atoms combined with the silicon atom whose number is one increases, a firm and precise barrier layer can be formed.

[0040] Formation of the barrier layer using above-mentioned polysilazane can be performed by [as being the following]. First, it applies and dries on the reflecting layer formed on the laminate, and the xylene solution of polysilazane is made immersed into hydrogen peroxide solution for about 2 to 4 hours. Next, the barrier layer which consists of silicas is formed by pulling up a laminate from hydrogen peroxide solution, and heating it at the temperature of about 100-150 degrees C for 1 to 48 hours.

[0041] Generally the layer which consists of a silica can also be formed with vacuum deposition or a sol-gel method. However, in vacuum deposition, even if it is difficult to form the film of sufficient thickness, it compares and forms, a crack and a pinhole will be generated. Moreover, in a sol-gel method, in order to change an alkoxide to an oxide, heating at very high temperature is needed. Therefore, it is inapplicable to the substrate using resin.

[0042] If above-mentioned polysilazane is used to it, it is about 100-150 degrees C in comparatively low temperature, and the silica film of sufficient thickness can be obtained. Thus, as for the thickness of the barrier layer formed, it is desirable that it is 0.5-2 micrometers, and it is more desirable that it is 1.5-2 micrometers. Sufficient oxygen barrier property and steam barrier property can be obtained without making the thickness and weight of a reflective mold conductivity substrate increase greatly, when the thickness of a barrier layer is in above-mentioned within the limits. Moreover, in an above-mentioned reflecting layer, although surface roughness cannot fully be reduced, when the thickness of a barrier layer is more than the above-mentioned lower limit, it becomes possible to fully reduce the surface roughness of a substrate.

[0043] As an ingredient used for a conductive layer with the reflective mold conductivity substrate of this invention, it is In2 O3-SnO2. Transparent conductive ingredients, such as mixture (ITO), TiO2 / Ag/TiO2, BiO3, SnO2 (F), CdSnO3, and V2 O5, nH2 O, can be mentioned. As for the thickness of this conductive layer, it is desirable to be formed by the thickness of 500-3000A.

[0044] As for the reflective mold conductivity substrate of this invention, the reflecting layer and the barrier layer may be formed in both sides of a laminate. One sectional view of the reflective mold conductivity substrate applied to other operation gestalten of this invention at drawing 2 is shown.

[0045] The laminating of a reflecting layer 23, the barrier layer 24, and the conductive layer 25 is carried out to one principal plane of a laminate 22 one by one, to the principal plane of another side, the laminating of a reflecting layer 26 and the barrier layer 27 is carried out one by one, and the reflective mold conductivity substrate 21 is constituted from drawing 2 .

[0046] Thus, if a reflective mold conductivity substrate is constituted so that it may become the symmetry to a laminate, the coefficient of thermal expansion in two principal planes of a laminate becomes equal, and even when heated, it will be hard to produce

deformation of curvature etc.
[0047] One sectional view of the reflective mold liquid crystal display possessing the reflective mold conductivity substrate mentioned above to drawing 3 is shown. The reflective mold liquid crystal display 31 counters with the field in which the conductive layer (not shown) of the reflective mold conductivity substrate 32 and this reflective mold conductivity substrate 32 was formed by drawing 3 , is formed, and consists of liquid crystal layers 34 prepared between the transparence resin substrate 33 with which the transparent electrode (not shown) was formed in the opposed face, and the reflective mold conductivity substrate 32 and the transparence resin substrate 33.
[0048] Thus, the usual transparence resin substrate used from the former as shown in drawing 5 as a transparence resin substrate 33 used with the reflective mold liquid crystal display constituted can be used. As mentioned above, the laminating of an anchor coat layer and the transparent electrode layer is carried out to one principal plane of a heat-resistant transparence resin film one by one, the laminating of a barrier layer and the rebound ace court layer is carried out one by one, and this transparence resin substrate is constituted by the principal plane of another side of a heat-resistant transparence resin film.
[0049] As an ingredient of the heat-resistant transparence resin film used for this transparence resin substrate, a polycarbonate, polyarylate and polyether sulphone, the norbornene system resin marketed as ARTON from Japan Synthetic Rubber Co., Ltd., the heat-curing mold arylation polyphenylene ether marketed as A-PPE from Asahi Chemical Co., Ltd. can be mentioned.
[0050] Moreover, although oxygen barrier property and steam barrier property are required also of the barrier layer used for this transparence resin substrate, generally the resin which has these functions in coincidence is not known except the resin containing a halogen atom. However, when the resin containing a halogen atom is used, isolation halogen ion will mix into a liquid crystal layer, and it will have a bad influence on the property of equipment. Therefore, it constitutes from bipolar membrane which usually piled up the resin film which has oxygen barrier property for a barrier layer, and the resin film which has steam barrier property.
[0051] As resin which has the oxygen barrier property which constitutes this transparence resin substrate, nylon, an ethylene-vinylalcohol copolymer, etc. can be mentioned and polyethylene etc. can be mentioned as resin which has steam barrier property. As for these resin film, it is desirable that it is the thickness of 5-10 micrometers. If thickness exceeds 10 micrometers, the light transmittance of a transparence resin substrate falls, and barrier property will become inadequate when thickness is less than 5 micrometers.
[0052] If the rebound ace court layer used with this transparence resin substrate is constituted from urethane resin, silicone resin, acrylic resin, etc., sufficient scratch-proof nature can be obtained. Moreover, an anchor coat layer usually consists of primers, coupling agents, etc., such as acrylic resin.
[0053] In addition, it is desirable to use that in which the barrier layer which consists of silica same with having explained the reflective mold conductivity substrate to one [at least] principal plane of an above-mentioned heat-resistant transparence resin film as a transparence resin substrate was formed. Thus, if a transparence resin substrate is constituted, high barrier property can be obtained with an easy configuration, and a reflective mold liquid crystal display can be lightweight[a thin shape and]-ized more.
[0054] As for the thickness of this barrier layer, it is desirable that it is 0.3-2.0 micrometers, and it is more desirable that it is 0.3-1.0 micrometers. Moreover, when this barrier layer is formed in both sides of a heat-resistant transparence resin film, barrier property becomes still higher and is desirable.
[0055] It consists of liquid crystal ingredients same with a liquid crystal layer being used with the usual reflective mold liquid crystal display with the reflective mold liquid crystal display of this invention. As mentioned above, although the reflective mold conductivity substrate of this invention was explained as what is used for a reflective mold liquid crystal display, it is possible to apply to the display using electroluminescence etc. for example.
[0056]
[Example] Hereafter, the example of this invention is explained.
(Example 1) As it was shown below, the reflective mold conductivity substrate (1) was produced.
[0057] First, etching processing was performed to glass epoxy copper clad laminate TLC551M whose width of face is 1m by 0.1mm in thickness marketed from Toshiba Chemical CORP., copper foil was exfoliated, and the laminate which consists of E glass was produced.
[0058] Heat-resistant white coating No.4264-2 of 1 acidity or alkalinity by OKITSUMO Co. which made silicone resin distribute a titania were infiltrated into this laminate, and the white coating was made it with ** to both sides of a laminate. By heating this at the temperature of 150 degrees C for 4 hours, the coating was stiffened and the reflecting layer whose thickness is 5 micrometers in the center section of a laminate was formed in both sides of a laminate.
[0059] Next, this laminate was immersed during the xylene solution which contains the low-temperature baking mold annular par hydronalium polysilazane by TONEN CORP. by 20% of the weight of concentration, and the TONEN polysilazane low-temperature baking mold N-L110 type, and this was dried for 30 minutes at the temperature of 80 degrees C. The barrier layer which thickness becomes from the silica which is 1.7 micrometers in the center section of a laminate was formed on the reflecting layer formed in both sides of a laminate by heating it at the temperature of 150 degrees C further for 2 hours, after making this laminate immersed into hydrogen peroxide solution for 4 hours.
[0060] In addition, since the dip painting cloth method was adopted in above-mentioned spreading, the thickness nonuniformity of the spreading film had arisen at the edge of a laminate. Then, the edge which becomes an oil level and parallel at the time of immersion was cut and removed by width of face of 10cm, respectively, and the edge which becomes an oil level and a perpendicular was cut and removed by width of face of 5cm, respectively.
[0061] Furthermore, the reflective mold conductivity substrate (1) was obtained by forming the ITO film with a thickness of 1000A in one principal plane of this laminate as a conductive layer by sputtering. In addition, the curvature of a substrate, bending, etc. were not produced at all on the occasion of production of a reflective mold conductivity substrate (1).
[0062] When the line coefficient of thermal expansion of the reflective mold conductivity substrate (1) produced as mentioned above was measured, it turned out that they are 1.4x10-5/degree C and a very small value. Moreover, it is Rmax when surface roughness was measured. It was 11nm.
[0063] (Example 2) As it was shown below, the reflective mold conductivity substrate (2) was produced. First, etching processing was performed to copper clad laminate CCL-H860 whose width of face is 1m by 0.1mm in thickness marketed from the Mitsubishi engineering plastics company, copper foil was exfoliated, and the laminate which consists of E glass was produced.

[0064] The reflective mold conductivity substrate (2) was produced like the example 1 except having used this laminate. In addition, the curvature of a substrate, bending, etc. were not produced at all on the occasion of production of a reflective mold conductivity substrate (2).
[0065] When the line coefficient of thermal expansion of the reflective mold conductivity substrate (2) produced as mentioned above was measured, it turned out that they are 1.3x10-5/degree C and a very small value. Moreover, it is Rmax when surface roughness was measured. It was 9nm.
[0066] (Example 3) As it was shown below, the reflective mold conductivity substrate (3) was produced. First, the thermosetting resin constituent which consists of ketone solvent which mixed phenol novolak resin and the epoxy resin of a bisphenol female mold by the weight ratio of 104:168 on the plain-weave fiber cloth T-740 with a thickness of 0.1mm it is thin from E. I. du Pont de Nemours and the Polly p-phenylene phthalamide fiber by the Toray Industries Kevlar company marketed from the SAKAI industrial company, and added latency strengthening catalyst Novacure 3721 by Asahi Chemical Co., Ltd. at 1.5% of the weight of a rate on it was infiltrated. This fiber cloth was dried at 80 degrees C for 1 hour, and two prepregs were produced.
[0067] The laminating of the prepreg of these two sheets is carried out so that MD or the direction of TD of each fiber cloth may cross mutually, and it is 40kg/cm2. The hotpress was performed at a pressure and the temperature of 150 degrees C, and the laminate was produced. In addition, the rate of the resinous principle in the produced laminate was 45 % of the weight, and thickness was 0.17mm.
[0068] The reflective mold conductivity substrate (3) was produced like the example 1 except having used this laminate. In addition, the curvature of a substrate, bending, etc. were not produced at all on the occasion of production of a reflective mold conductivity substrate (3).
[0069] When the line coefficient of thermal expansion of the reflective mold conductivity substrate (3) produced as mentioned above was measured, it turned out that they are 1.1x10-5/degree C and a very small value. Moreover, it is Rmax when surface roughness was measured. It was 7nm.
[0070] Moreover, as it was shown below, the transparence resin substrate (1) used as an opposite substrate of a reflective mold liquid crystal display and (2) were produced.
- Transparence resin substrate (1)
The polyether sulphone film with a thickness of 100 micrometers for optics marketed from the Mitsui Tonosho chemistry company was immersed during the TONEN polysilazane low-temperature baking mold N-L110 type by TONEN CORP. which is the xylene solution which contains low-temperature baking mold annular par hydronalium polysilazane by 20% of the weight of concentration, and this was dried for 30 minutes at the temperature of 80 degrees C. The barrier layer which thickness becomes from the silica which is 0.5 micrometers was formed in both sides of a polyether sulphone film by heating it at the temperature of 150 degrees C further for 2 hours, after making this polyether sulphone film immersed into hydrogen peroxide solution for 4 hours.
[0071] Furthermore, the ITO film with a thickness of 1000A was formed in one principal plane of this polyether sulphone film as a conductive layer by sputtering, and the transparence resin substrate (1) was produced.
[0072] When the line coefficient of thermal expansion of the transparence resin substrate (1) produced as mentioned above was measured, it turned out that they are 5.5x10-5/degree C and a little big value. Moreover, it is Rmax when surface roughness was measured. It was 10nm.
[0073] - Transparence resin substrate (2)
To both sides of the hardening film of the thermosetting arylation polyphenylene ether with a thickness of 100 micrometers marketed from Asahi Chemical Co., Ltd., like the above-mentioned transparence resin substrate (1), the barrier layer which consists of a silica was formed, the ITO film was formed in the principal plane of one of these as a conductive layer, and the transparence resin substrate (2) was produced.
[0074] When the line coefficient of thermal expansion of the transparence resin substrate (2) produced as mentioned above was measured, it turned out that they are 3.5x10-5/degree C and a little big value. Moreover, it is Rmax when surface roughness was measured. It was 8nm.
[0075] The above-mentioned reflective mold conductivity substrate (1) The comparison of weight and thickness was performed about alkali-free-glass substrate OA-2 [with a thickness of 0.7mm] marketed from - (3), a transparence resin substrate (1), (2), and Nippon Electric Glass Co., Ltd. The result is shown in Table 1.
[0076]
[Table 1]

	相対的重量	厚さ（mm）
反射型導電性基板（１）	0.12	0.1
反射型導電性基板（２）	0.13	0.1
反射型導電性基板（３）	0.17	0.2
透明樹脂基板（１）	0.08	0.1
透明樹脂基板（２）	0.07	0.1
ＯＡ－２基板	1	0.7

[0077] In Table 1, the weight of reflective mold conductivity substrate (1) - (3) and a transparence resin substrate (1), and (2) is shown by the relative value to the weight of OA-2 substrate. The reflective mold conductivity substrates and transparence resin substrates of this invention are a light weight and a thin shape compared with a glass substrate so that clearly from Table 1.
[0078] Moreover, reflective mold conductivity substrate [of the above-mentioned examples 1-3] (1) - (3), a transparence resin substrate (1), The transparence resin substrate AMOREX film with a thickness of 100 micrometers which used the polycarbonate as the base film marketed from (2) and a Fujimori industrial company, And measurement of the moisture vapor transmission under 40-degree C temperature and the humidity conditions of 60%RH and oxygen permeability was performed about transparence resin substrate FST-5337 [with a thickness of 100 micrometers which is marketed from Sumitomo Bakelite Co., Ltd. and which used polyether sulphone as the base film]. The result is shown in Table 2.
[0079]
[Table 2]

	水蒸気透過率 (g/m²・day)	酸素透過率 (cc/24hr・atm・m²)
反射型導電性基板（1）	0.5	0.1以下
反射型導電性基板（2）	0.7	0.1以下
反射型導電性基板（3）	0.7	0.1以下
透明樹脂基板（1）	2.7	0.1以下
透明樹脂基板（2）	2.3	0.1以下
ＡＭＯＲＥＸ	11	0.1以下
ＦＳＴ－５３３７	57	1.5

[0080] As shown in Table 2, it turns out that reflective mold conductivity substrate [of examples 1-3] (1) - (3) shows good steam barrier property. Although a transparence resin substrate (1) and (2) have low steam barrier property compared with reflective mold conductivity substrate (1) - (3), they show high steam barrier property as compared with AMOREX and FST-5337.
[0081] Moreover, it turns out that reflective mold conductivity substrate (1) - (3) and a transparence resin substrate (1), and (2) show sufficient oxygen barrier property.
(Example 4) As it was shown below, the reflective mold liquid crystal display was produced.
[0082] First, patterning of the conductive layer of the reflective mold conductivity substrate (2) produced in the example 2 was carried out, and the array electrode substrate was produced. The orientation film was formed by applying the polyimide film to the electrode surface of this array electrode substrate, and performing rubbing processing.
[0083] Next, by applying the polyimide film and performing rubbing processing, the orientation film was formed in the field in which the conductive layer of the above-mentioned transparence resin substrate (2) was formed, and the common electrode substrate was formed in it.
[0084] The spacer which consists of a silica particle was sprinkled, the array electrode substrate and the common electrode substrate were stuck on it using the sealing compound which consists of an epoxy resin, as each electrode surface countered the electrode surface of the array electrode substrate formed as mentioned above, and the liquid crystal cell was produced.
[0085] After pouring in a liquid crystal ingredient from opening of this liquid crystal cell, opening was closed, the polarization film with a thickness of 0.2mm which is from polyvinyl-butyral-iodine on the screen side of a common electrode substrate was stuck, and the 5 inches reflective mold liquid crystal display was produced.
[0086] In addition, the trouble on the process by deformation of the curvature of a reflective mold conductivity substrate, bending, etc. was not produced on the occasion of production of a reflective mold liquid crystal display. Moreover, even if it carried out the drop test of this reflective mold liquid crystal display from height of 1.5m, breakage did not produce it.
[0087] (Example 5) The 5 inches reflective mold liquid crystal display was produced like the example 4 except having formed the array electrode substrate using the reflective mold conductivity substrate produced in the example 1, and having formed the common electrode substrate using the above-mentioned transparence resin substrate.
[0088] In addition, the trouble on the process by deformation of the curvature of a reflective mold conductivity substrate, bending, etc. was not produced on the occasion of production of a reflective mold liquid crystal display. Moreover, even if it carried out the drop test of this reflective mold liquid crystal display from height of 1.5m, breakage did not produce it.
[0089] (Example 6) The 5 inches reflective mold liquid crystal display was produced like the example 4 except having formed the array electrode substrate using the reflective mold conductivity substrate produced in the example 3.
[0090] In addition, the trouble on the process by deformation of the curvature of a reflective mold conductivity substrate, bending, etc. was not produced on the occasion of production of a reflective mold liquid crystal display. Moreover, even if it carried out the drop test of this reflective mold liquid crystal display from height of 1.5m, breakage did not produce it.
[0091] (Example 7) The reflective mold liquid crystal display was produced like the example 4 except having made size into 7 inches.
[0092] In addition, the trouble on the process by deformation of the curvature of a reflective mold conductivity substrate, bending, etc. was not produced on the occasion of production of size of a reflective mold liquid crystal display as for 7 inches. Moreover, even if it dropped this reflective mold liquid crystal display from height of 1.5m, breakage did not produce it.
[0093] (Example 8) The reflective mold liquid crystal display was produced like the example 5 except having made size into 7 inches.
[0094] In addition, the trouble on the process by deformation of the curvature of a reflective mold conductivity substrate, bending, etc. was not produced on the occasion of production of size of a reflective mold liquid crystal display as for 7 inches. Moreover, even if it dropped this reflective mold liquid crystal display from height of 1.5m, breakage did not produce it.
[0095] (Example 9) The reflective mold liquid crystal display was produced like the example 6 except having made size into 7 inches.
[0096] In addition, the trouble on the process by deformation of the curvature of a reflective mold conductivity substrate, bending, etc. was not produced on the occasion of production of size of a reflective mold liquid crystal display as for 7 inches. Moreover, even if it dropped this reflective mold liquid crystal display from height of 1.5m, breakage did not produce it.
[0097] (Example 1 of a comparison) The liquid crystal cell was produced like the example 4 except having produced the array electrode substrate and the common electrode substrate using the transparence resin substrate AMOREX film with a thickness of 100 micrometers which used the polycarbonate as the base film marketed from the Fujimori industrial company.
[0098] Next, by applying heat-resistant white coating No.4264-2 of 1 acidity or alkalinity by OKITSUMO Co. which made silicone resin distribute a titania, and heating at the temperature of 150 degrees C for 4 hours, the rear face of the electrode surface of the array electrode substrate of this liquid crystal cell was made to harden a coating, and the reflecting layer whose thickness is 5 micrometers was formed in it.
[0099] After pouring in a liquid crystal ingredient from opening of this liquid crystal cell, opening was closed, the polarization film with a thickness of 0.2mm which is from polyvinyl-butyral-iodine on the screen side of a common electrode substrate was stuck, and the 5 inches reflective mold liquid crystal display was produced.
[0100] In addition, on the occasion of production of this reflective mold liquid crystal display, bending of a transparence resin substrate arose at the conveyance process of a substrate, at the seal process, the curvature of a transparence resin substrate arose and the positioning trouble arose. Therefore, the location precision of the produced liquid crystal cell became inadequate.

[0101] Breakage was not produced when this reflective mold liquid crystal display was dropped from height of 1.5m.
(Example 2 of a comparison) The reflective mold liquid crystal display was produced like the example 1 of a comparison except having produced the array electrode substrate and the common electrode substrate using transparence resin substrate FST-5337 [with a thickness of 100 micrometers which is marketed and which used polyether sulphone as the base film] from Sumitomo Bakelite Co., Ltd.
[0102] In addition, also on the occasion of production of this reflective mold liquid crystal display, bending of a transparence resin substrate arose at the conveyance process of a substrate, at the seal process, the curvature of a transparence resin substrate arose and the positioning trouble arose. Therefore, the location precision of the produced liquid crystal cell became inadequate.
[0103] Breakage was not produced when this reflective mold liquid crystal display was dropped from height of 1.5m.
(Example 3 of a comparison) The liquid crystal cell was produced like the example 4 except having produced the array electrode substrate using alkali-free-glass substrate OA-2 [with a thickness of 0.7mm] marketed from Nippon Electric Glass Co., Ltd., and having produced the common electrode substrate using transparence resin substrate FST-5337 [with a thickness of 100 micrometers which is marketed from Sumitomo Bakelite Co., Ltd. and which used polyether sulphone as the base film].
[0104] After pouring in a liquid crystal ingredient from opening of this liquid crystal cell, opening was closed and the polarization film with a thickness of 0.2mm which is from polyvinyl-butyral-iodine on the screen side of a common electrode substrate was stuck.
[0105] Next, white PET with a thickness of 200 micrometers which is marketed from Toray Industries, Inc. and which made PET distribute a titania, and E22 have been arranged as a reflecting layer at the rear face of the electrode surface of the array electrode substrate of this liquid crystal cell, and the 5 inches reflective mold liquid crystal display was produced at it.
[0106] In addition, the trouble on the process by deformation of the curvature of a reflective mold conductivity substrate, bending, etc. was not produced on the occasion of production of a reflective mold liquid crystal display. However, when this reflective mold liquid crystal display was dropped from height of 1.5m, breakage produced it in the array electrode substrate.
[0107] (Example 4 of a comparison) The reflective mold liquid crystal display was produced like the example 3 of a comparison except having produced the common electrode substrate using alkali-free-glass substrate OA-2 [with a thickness of 0.7mm] marketed from Nippon Electric Glass Co., Ltd.
[0108] In addition, the trouble on the process by deformation of the curvature of a reflective mold conductivity substrate, bending, etc. was not produced on the occasion of production of a reflective mold liquid crystal display. However, when this reflective mold liquid crystal display was dropped from height of 1.5m, breakage produced it in the array electrode substrate and the common electrode substrate.
[0109] The comparison of weight and thickness was performed about the reflective mold liquid crystal display of the above-mentioned examples 4-9 and the examples 1-4 of a comparison. The result is shown in Table 3.
[0110]
[Table 3]

	相対的重量	厚さ (mm)
実施例4	0.15	0.5
実施例5	0.17	0.5
実施例6	0.19	0.6
実施例7	0.30	0.5
実施例8	0.34	0.5
実施例9	0.38	0.7
比較例1	0.11	0.7
比較例2	0.10	0.7
比較例3	0.44	1.3
比較例4	1	1.9

[0111] In Table 3, the weight of the reflective mold liquid crystal display of examples 4-9 and the examples 1-3 of a comparison is shown by the relative value to the weight of the reflective mold liquid crystal display of the example 4 of a comparison. Compared with the reflective mold liquid crystal display of the examples 3 and 4 of a comparison, it turns out that the reflective mold liquid crystal display of examples 1-9 is fully lightweight so that clearly from Table 3. Moreover, it turns out that the reflective mold liquid crystal display of examples 4-9 has the reflective mold liquid crystal display of the examples 1 and 2 of a comparison, an EQC, or the thickness not more than it, and it is sharply thin-shape-ized compared with the reflective mold liquid crystal display of the examples 3 and 4 of a comparison.
[0112]
[Effect of the Invention] As shown above, according to this invention, on the laminate with which a reflective mold conductivity substrate consists of a fiber cloth hardened with resin Since it is constituted by carrying out the laminating of the reflecting layer containing white pigments and resin, the barrier layer which consists of a silica, and the conductive layer one by one It has lightweight and sufficient shock resistance, oxygen barrier property, steam barrier property, and scratch-proof nature, and a configuration is easy and the manufacture approach of a heat-resistant and rigid high reflective mold conductivity substrate, a reflective mold liquid crystal display, and a reflective mold conductivity substrate can be offered.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention relates to the manufacture approach of a reflective mold conductivity substrate, a reflective mold liquid crystal display, and a reflective mold conductivity substrate, and relates to the manufacture approach of the reflective mold conductivity substrate suitable for the liquid crystal display especially carried in a Personal Digital Assistant device, a reflective mold liquid crystal display, and a reflective mold conductivity substrate.

[Translation done.]

PRIOR ART

[Description of the Prior Art] In recent years, the need of a small Personal Digital Assistant device is increasing with progress of satellite communication or migration communication technology. The display carried in many of Personal Digital Assistant devices is asked for it being a thin shape, and the liquid crystal display is most used abundantly.
[0003] Moreover, since it is required for the display for Personal Digital Assistant devices that it is a low power and that the visibility under outdoor daylight should be high, the reflective mold liquid crystal display is used abundantly rather than the transparency mold liquid crystal display.
[0004] One sectional view of the conventional reflective mold liquid crystal display is shown in drawing 4 . The liquid crystal layer 44 prepared between the conductive substrates 42 and 43 of a pair with which the reflective mold liquid crystal display 41 has been arranged face to face, and the electrode layer was formed in each opposed face by drawing 4 , and which consist of glass, and the conductive substrates 42 and 43 of these pairs, and the liquid crystal layer of the conductive substrate 42 consist of light reflex layers 45 which consist of mixture of the white pigments and PET which were prepared in the field of the opposite side etc.
[0005] Thus, the light reflex layer 45 is formed instead of the back light generally used for a reflective mold liquid crystal display with a transparency mold liquid crystal display. The conductive substrate used with an above-mentioned reflective mold liquid crystal display is a transparency mold conductivity substrate with which the conductive layer which consists of a transparent conductive ingredient was generally formed on the glass plate with a thickness of 0.7-1.1mm which has optical properties, such as the Takamitsu transmission, low Hayes, and a low retardation.
[0006] Since the glass plate which has thermal resistance and chemical resistance is used for this transparency mold conductivity substrate, it has sufficient reinforcement, for example to processing of the photo etching performed in processes in manufacture of a liquid crystal display, such as formation of the orientation film, and electrode formation, sputtering, etc.
[0007] Moreover, properties, such as oxygen barrier property required of a conductive substrate, steam barrier property, and scratch-proof nature, are also good. However, since glass is used for the above-mentioned transparency mold conductivity substrate, its shock resistance is low and is very heavy. Since shock resistance falls further when thickness of a glass plate is made thin, in order to lightweight-ize a substrate, lightweight-izing is difficult. Therefore, using resin films, such as plastics, for a conductive substrate is examined by the small Personal Digital Assistant device currently asked for high shock resistance and a lightweight thing.
[0008] One sectional view of the conductive substrate which used the conventional resin film for drawing 5 is shown. The laminating of the anchor coat layer 53 and the transparent electrode layer 54 is carried out to one principal plane of the heat-resistant transparence resin film 52 one by one, the laminating of the barrier layer 55 and the rebound ace court layer 56 is carried out one by one, and the conductive substrate 51 is constituted from drawing 5 by the principal plane of another side of the heat-resistant transparence resin film 52.
[0009] The conductive substrate using a resin film is lightweight, without being divided unlike a glass plate. However, single resin cannot be made to pay all the functions, such as oxygen barrier property, steam barrier property, and scratch-proof nature, generally. Therefore, in the conductive substrate 51 using a resin film, the barrier layer 55 which has oxygen barrier property and steam barrier property, and the rebound ace court layer 56 which has scratch-proof nature are needed.
[0010] Moreover, on the heat-resistant-resin film 52, the transparent electrode layer 54 cannot be formed directly. Therefore, it is necessary to form the anchor coat layer 53 between the heat-resistant-resin film 52 and the transparent electrode layer 54.
[0011] In addition, although the barrier layer 55 is the monolayer which has oxygen barrier property and steam barrier property, since it is very difficult to give oxygen barrier property and steam barrier property to single resin, the barrier layer 55 is usually constituted from drawing 5 by the two-layer structure which carried out the laminating of the layer which has oxygen barrier property, and the layer which has steam barrier property. However, generally, the resin which has steam barrier property has high surface energy, and its familiarity by other resin is low. Therefore, in order to paste up other resin on the resin which has steam barrier property, it is necessary to perform surface treatment.
[0012] Thus, in manufacture of the conductive substrate using a resin film, since it is necessary to carry out the laminating of a huge number of the resin layers and many processes are needed, the problem that a production process becomes complicated will be produced.
[0013] Moreover, a line coefficient of thermal expansion is large, since the conductive substrate using a resin film is formed by carrying out the laminating of two or more resin layers from which coefficient of thermal expansion differs, it is easy to produce the curvature of a substrate etc. in the case of a heating process, and thermal resistance, such as heat dimensional stability, is low [a substrate]. Furthermore, since this conductive substrate is deficient in rigidity, deformation of substrates, such as above-mentioned curvature and bending, produces it easily.
[0014] Therefore, if both conductive substrates 62 and 63 of a pair are constituted from resin as shown in drawing 6 , the problem that the alignment of a substrate etc. becomes difficult will be produced in the case of manufacture of a liquid crystal display. Since a hotter process becomes ** when forming an array electrode, this problem becomes remarkable especially.
[0015] Moreover, if one conductive substrate 72 is constituted from glass among the conductive substrates 72 and 73 of a pair and the conductive substrate 73 of another side is constituted from resin as shown in drawing 7 , problems, such as alignment of an above-mentioned substrate, will not be produced. However, since glass is used, the problem that shock resistance is low and lightweight-

ization becomes difficult is produced.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] As shown above, according to this invention, on the laminate with which a reflective mold conductivity substrate consists of a fiber cloth hardened with resin Since it is constituted by carrying out the laminating of the reflecting layer containing white pigments and resin, the barrier layer which consists of a silica, and the conductive layer one by one It has lightweight and sufficient shock resistance, oxygen barrier property, steam barrier property, and scratch-proof nature, and a configuration is easy and the manufacture approach of a heat-resistant and rigid high reflective mold conductivity substrate, a reflective mold liquid crystal display, and a reflective mold conductivity substrate can be offered.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] As mentioned above, the configuration became complicated and the conductive substrate used with the conventional reflective mold liquid crystal display needed many processes for manufacture of a substrate, in order to obtain lightweight-izing and sufficient shock resistance, the oxygen barrier property, steam barrier property, and scratch-proof nature of a substrate. Moreover, since thermal resistance and rigidity were low, it was easy to produce deformation of curvature, bending, etc., and manufacture of a display etc. was difficult.
[0017] It is lightweight and has sufficient shock resistance, oxygen barrier property, steam barrier property, and scratch-proof nature, and a configuration is easy and this invention aims at a thin shape and offering the manufacture approach of a reflective mold conductivity substrate with high thermal resistance and rigidity, a reflective mold liquid crystal display, and a reflective mold conductivity substrate.

[Translation done.]

MEANS

[Means for Solving the Problem] This invention offers the reflective mold conductivity substrate characterized by providing the laminate containing the fiber cloth which resin was infiltrated and was stiffened, the reflecting layer formed on said laminate including white pigments and resin, the barrier layer formed on said reflecting layer including the silica, and the conductive layer formed on said barrier layer.
[0019] This invention is characterized by generating the silica which constitutes said barrier layer from the polysilazane which has cyclic structure in the above-mentioned reflective mold conductivity substrate. This invention is characterized by forming said reflecting layer and a barrier layer in both sides of said laminate in the above-mentioned reflective mold conductivity substrate.
[0020] Moreover, the laminate with which this invention contains the fiber cloth which infiltrated resin and stiffened it, The reflecting layer formed on said laminate including white pigments and resin, and the barrier layer formed on said reflecting layer including the silica, The reflective mold conductivity substrate equipped with the conductive layer formed on said barrier layer, The reflective mold liquid crystal display characterized by providing the liquid crystal layer prepared between the transparence resin substrate with which it countered with the field in which the conductive layer of said reflective mold conductivity substrate was formed, and was prepared, and the transparent electrode was formed in the opposed face, and said reflective mold conductivity substrate and a transparence resin substrate is offered.
[0021] Furthermore, the process which applies and heats the mixture of white pigments and thermosetting resin, and forms a reflecting layer in one principal plane of the laminate which this invention made the fiber cloth the core material, and resin was infiltrated, and was stiffened, The manufacture approach of the reflective mold conductivity substrate characterized by providing the process which forms the barrier layer containing a silica, and the process which forms a conductive layer on said barrier layer is offered by applying and heat-treating the polysilazane which has cyclic structure on said reflecting layer.
[0022]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained more to a detail, referring to a drawing. One sectional view of the reflective mold conductivity substrate applied to 1 operation gestalt of this invention at drawing 1 is shown.
[0023] The reflective mold conductivity substrate 11 carries out the laminating of the reflecting layer 13 which contains white pigments and resin in one principal plane of the laminate 12 which consists of a fiber cloth into which thermosetting resin was infiltrated, the barrier layer 14 which consists of a silica, and the conductive layer 15 one by one, and consists of drawing 1 .
[0024] Although the laminate used with the reflective mold conductivity substrate of this invention consists of a fiber cloth into which thermosetting resin was infiltrated, it can mention filaments, such as glass, such as E glass, D glass, and S glass, and resin, such as aromatic polyamide, as an ingredient of the fiber cloth used.
[0025] As for the path of this filament, it is desirable that it is 20 micrometers or less. using the filament of a diameter 20 micrometers or less -- a reflective mold conductivity substrate -- thin-shape-izing -- and it can lightweight-ize and the mechanical strength of a substrate can be raised.
[0026] although it can also use as a nonwoven fabric, without weaving when using these filaments as a fiber cloth -- a plain weave and Chu-tzu -- it is desirable to weave by weave, such as textile and twill, and to use as textile fabrics. Moreover, as for the thickness of a fiber cloth, it is desirable that it is 30-100 micrometers, and it is more desirable that it is 30-50 micrometers. the case where the thickness of a fiber cloth is in above-mentioned within the limits -- a reflective mold conductivity substrate -- thin-shape-izing -- and it can lightweight-ize and the mechanical strength of a substrate can be raised.
[0027] In addition, the surface roughness of the fiber cloth produced changes according to the weave of a filament. the case where a fiber cloth is produced using the same filament -- surface roughness -- twill and Chu-tzu -- although it becomes high in order of textile and a plain weave, a substrate front face can be graduated by forming a barrier layer by sufficient thickness.
[0028] Moreover, when producing a fiber cloth with a plain weave, sinking in to the fiber cloth of the below-mentioned resin becomes easy, and the manufacturing cost of a laminate can be reduced. Thermosetting resin sinks into the fiber cloth explained above. As resin used for sinking in to a fiber cloth, the heat-resistant high thermosetting resin of phenol resin-epoxy resin mixture, bismaleimide-triazine resin mixture, etc. can be mentioned. If the epoxy resin of a bisphenol mold is used as an epoxy resin, using phenol novolak resin as phenol resin, since high thermal resistance can be obtained, it is especially desirable.
[0029] Although what is guided from diamino diphenylmethane can be used as bismaleimide, that to which the phenyl group of diamino diphenylmethane is guided from the compound permuted by the alkyl group may be used. Moreover, triazine resin can be obtained by the demineralization acid reaction of bisphenol A and a cyanogen chloride. In addition, what is marketed from the Mitsubishi engineering plastics company as such bismaleido triazine resin mixture as BT resin by which the epoxy resin etc. was added can be used.
[0030] As the laminate used with the reflective mold conductivity substrate of this invention is shown below, it is manufactured. First, an above-mentioned thermosetting resin constituent is melted to organic solvents, such as ketone solvent, and the above-mentioned fiber cloth is infiltrated. This is dried primarily, and prepreg is produced and formed into B stage. It is 20-60kg/cm2, heating this prepreg at about 150-180 degrees C using for example, a two-sheet pile and a hotpress. It pressurizes by the pressure of extent. Furthermore, a laminate is obtained by heating this at about 150-180 degrees C, and stiffening thermosetting resin. As for the rate of the resinous principle in a laminate, it is desirable to be controlled to 40 - 60% of the weight.
[0031] Although the laminate manufactured as mentioned above is the configuration of having piled up two fiber cloths, it is a light

weight and a thin shape, and if sufficient mechanical strength can be obtained, there will be especially no limit in the number of laminatings. However, in order to control the anisotropy of a laminate, as for a laminate, it is desirable to consider as the configuration which piled up even fiber cloths, and it is most desirable to consider as the configuration repeated two sheets from a viewpoint of lightweight-izing.

[0032] As for the thickness of this laminate, it is desirable that it is 50-200 micrometers, and it is more desirable that it is 50-100 micrometers. the case where the thickness of a laminate is in above-mentioned within the limits -- a reflective mold conductivity substrate -- thin-shape-izing -- and it can lightweight-ize and the mechanical strength of a substrate can be raised.

[0033] Moreover, the laminate which is marketed from the laminate manufacturer and with which the metallic foil was stretched on the front face may be used as a laminate used with the reflective mold conductivity substrate of this invention. In addition, the metallic foil stretched by such laminate marketed is easily removable by etching.

[0034] With the reflective mold conductivity substrate of this invention, white pigments like a titania generally used can be mentioned as white pigments used for a reflecting layer. A reflecting layer is formed by making the thermosetting silicone resin distributed in the BTX solvent distribute these white pigments, applying and drying and heating this further to a laminate.

[0035] At this time, as for the weight ratio (P/R ratio) of white pigments to silicone resin, it is desirable that it is 2.5-6, and it is more desirable that it is 4-6. When a P/R ratio is more than the above-mentioned lower limit, the line coefficient of thermal expansion of each class which constitutes a reflective mold conductivity substrate can be made low, and the heat dimensional stability of a substrate can be raised. However, if a P/R ratio exceeds the above-mentioned upper limit, distribution of white pigments will become difficult.

[0036] As for the thickness of this reflecting layer, it is desirable that it is 5-10 micrometers. Without making the thickness and weight of a reflective mold conductivity substrate increase greatly, when the thickness of a reflecting layer is within the limits of this, it can be white, and the color of a laminate can be concealed, and until can reduce surface roughness to some extent.

[0037] The barrier layer of the reflective mold conductivity substrate of this invention can consist of silicas. As for the silica which constitutes this barrier layer, obtaining from polysilazane is desirable. Polysilazane is general formula H3 Si(NHSiH2) n NHSiH3. The silazane and general formula n (SiH2 NH) of the shape of a shown straight chain It is the polymer which makes a frame the shown cyclo silazane. If these polysilazane is carried out hydrolysis and a polycondensation by predetermined processing, Si-N association of polysilazane will be severed, Si-O association will be produced, and a silica and ammonia will be produced. Therefore, when it has the hydrogen atom which polysilazane combines with a silicon atom, the hydrogen atom combined with a silicon atom remains also in the silica to generate.

[0038] If the polysilazane of the low-temperature baking mold which has cyclic structures, such as annular par hydronalium polysilazane by which Pd complexes, such as TONEN polysilazane low-temperature baking mold N-L110 type marketed from TONEN CORP., were added as a catalyst as polysilazane, is used, since polysilazane is changeable into a silica by heating at the comparatively low temperature of about 100-150 degrees C, it is desirable.

[0039] If the polysilazane which has condensed-ring structure is used as polysilazane of the low-temperature baking mold which has cyclic structure especially, the rate of the hydrogen atom combined with a silicon atom decreases in the silica which is a resultant, and since the number of the oxygen atoms combined with the silicon atom whose number is one increases, a firm and precise barrier layer can be formed.

[0040] Formation of the barrier layer using above-mentioned polysilazane can be performed by [as being the following]. First, it applies and dries on the reflecting layer formed on the laminate, and the xylene solution of polysilazane is made immersed into hydrogen peroxide solution for about 2 to 4 hours. Next, the barrier layer which consists of silicas is formed by pulling up a laminate from hydrogen peroxide solution, and heating it at the temperature of about 100-150 degrees C for 1 to 48 hours.

[0041] Generally the layer which consists of a silica can also be formed with vacuum deposition or a sol-gel method. However, in vacuum deposition, even if it is difficult to form the film of sufficient thickness, it compares and forms, a crack and a pinhole will be generated. Moreover, in a sol-gel method, in order to change an alkoxide to an oxide, heating at very high temperature is needed. Therefore, it is inapplicable to the substrate using resin.

[0042] If above-mentioned polysilazane is used to it, it is about 100-150 degrees C in comparatively low temperature, and the silica film of sufficient thickness can be obtained. Thus, as for the thickness of the barrier layer formed, it is desirable that it is 0.5-2 micrometers, and it is more desirable that it is 1.5-2 micrometers. Sufficient oxygen barrier property and steam barrier property can be obtained without making the thickness and weight of a reflective mold conductivity substrate increase greatly, when the thickness of a barrier layer is in above-mentioned within the limits. Moreover, in an above-mentioned reflecting layer, although surface roughness cannot fully be reduced, when the thickness of a barrier layer is more than the above-mentioned lower limit, it becomes possible to fully reduce the surface roughness of a substrate.

[0043] As an ingredient used for a conductive layer with the reflective mold conductivity substrate of this invention, it is In2 O3-SnO2. Transparent conductive ingredients, such as mixture (ITO), TiO2 / Ag/TiO2, BiO3, SnO2 (F), CdSnO3, and V2 O5, nH2 O, can be mentioned. As for the thickness of this conductive layer, it is desirable to be formed by the thickness of 500-3000A.

[0044] As for the reflective mold conductivity substrate of this invention, the reflecting layer and the barrier layer may be formed in both sides of a laminate. One sectional view of the reflective mold conductivity substrate applied to other operation gestalten of this invention at drawing 2 is shown.

[0045] The laminating of a reflecting layer 23, the barrier layer 24, and the conductive layer 25 is carried out to one principal plane of a laminate 22 one by one, to the principal plane of another side, the laminating of a reflecting layer 26 and the barrier layer 27 is carried out one by one, and the reflective mold conductivity substrate 21 is constituted from drawing 2 .

[0046] Thus, if a reflective mold conductivity substrate is constituted so that it may become the symmetry to a laminate, the coefficient of thermal expansion in two principal planes of a laminate becomes equal, and even when heated, it will be hard to produce deformation of curvature etc.

[0047] One sectional view of the reflective mold liquid crystal display possessing the reflective mold conductivity substrate mentioned above to drawing 3 is shown. The reflective mold liquid crystal display 31 counters with the field in which the conductive layer (not shown) of the reflective mold conductivity substrate 32 and this reflective mold conductivity substrate 32 was formed by drawing 3 , is formed, and consists of liquid crystal layers 34 prepared between the transparence resin substrate 33 with which the transparent electrode (not shown) was formed in the opposed face, and the reflective mold conductivity substrate 32 and the transparence resin

substrate 33.

[0048] Thus, the usual transparence resin substrate used from the former as shown in drawing 5 as a transparence resin substrate 33 used with the reflective mold liquid crystal display constituted can be used. As mentioned above, the laminating of an anchor coat layer and the transparent electrode layer is carried out to one principal plane of a heat-resistant transparence resin film one by one, the laminating of a barrier layer and the rebound ace court layer is carried out one by one, and this transparence resin substrate is constituted by the principal plane of another side of a heat-resistant transparence resin film.

[0049] As an ingredient of the heat-resistant transparence resin film used for this transparence resin substrate, a polycarbonate, polyarylate and polyether sulphone, the norbornene system resin marketed as ARTON from Japan Synthetic Rubber Co., Ltd., the heat-curing mold arylation polyphenylene ether marketed as A-PPE from Asahi Chemical Co., Ltd. can be mentioned.

[0050] Moreover, although oxygen barrier property and steam barrier property are required also of the barrier layer used for this transparence resin substrate, generally the resin which has these functions in coincidence is not known except the resin containing a halogen atom. However, when the resin containing a halogen atom is used, isolation halogen ion will mix into a liquid crystal layer, and it will have a bad influence on the property of equipment. Therefore, it constitutes from bipolar membrane which usually piled up the resin film which has oxygen barrier property for a barrier layer, and the resin film which has steam barrier property.

[0051] As resin which has the oxygen barrier property which constitutes this transparence resin substrate, nylon, an ethylene-vinylalcohol copolymer, etc. can be mentioned and polyethylene etc. can be mentioned as resin which has steam barrier property. As for these resin film, it is desirable that it is the thickness of 5-10 micrometers. If thickness exceeds 10 micrometers, the light transmittance of a transparence resin substrate falls, and barrier property will become inadequate when thickness is less than 5 micrometers.

[0052] If the rebound ace court layer used with this transparence resin substrate is constituted from urethane resin, silicone resin, acrylic resin, etc., sufficient scratch-proof nature can be obtained. Moreover, an anchor coat layer usually consists of primers, coupling agents, etc., such as acrylic resin.

[0053] In addition, it is desirable to use that in which the barrier layer which consists of silica same with having explained the reflective mold conductivity substrate to one [at least] principal plane of an above-mentioned heat-resistant transparence resin film as a transparence resin substrate was formed. Thus, if a transparence resin substrate is constituted, high barrier property can be obtained with an easy configuration, and a reflective mold liquid crystal display can be lightweight[a thin shape and]-ized more.

[0054] As for the thickness of this barrier layer, it is desirable that it is 0.3-2.0 micrometers, and it is more desirable that it is 0.3-1.0 micrometers. Moreover, when this barrier layer is formed in both sides of a heat-resistant transparence resin film, barrier property becomes still higher and is desirable.

[0055] It consists of liquid crystal ingredients same with a liquid crystal layer being used with the usual reflective mold liquid crystal display with the reflective mold liquid crystal display of this invention. As mentioned above, although the reflective mold conductivity substrate of this invention was explained as what is used for a reflective mold liquid crystal display, it is possible to apply to the display using electroluminescence etc. for example.

[Translation done.]

EXAMPLE

[Example] Hereafter, the example of this invention is explained.
(Example 1) As it was shown below, the reflective mold conductivity substrate (1) was produced.
[0057] First, etching processing was performed to glass epoxy copper clad laminate TLC551M whose width of face is 1m by 0.1mm in thickness marketed from Toshiba Chemical CORP., copper foil was exfoliated, and the laminate which consists of E glass was produced.
[0058] Heat-resistant white coating No.4264-2 of 1 acidity or alkalinity by OKITSUMO Co. which made silicone resin distribute a titania were infiltrated into this laminate, and the white coating was made it with ** to both sides of a laminate. By heating this at the temperature of 150 degrees C for 4 hours, the coating was stiffened and the reflecting layer whose thickness is 5 micrometers in the center section of a laminate was formed in both sides f a laminate.
[0059] Next, this laminate was immersed during the xylene solution which contains the low-temperature baking mold annular par hydronalium polysilazane by TONEN CORP. by 20% of the weight of concentration, and the TONEN polysilazane low-temperature baking mold N-L110 type, and this was dried for 30 minutes at the temperature of 80 degrees C. The barrier layer which thickness becomes from the silica which is 1.7 micrometers in the center section of a laminate was formed on the reflecting layer formed in both sides of a laminate by heating it at the temperature of 150 degrees C further for 2 hours, after making this laminate immersed into hydrogen peroxide solution for 4 hours.
[0060] In addition, since the dip painting cloth method was adopted in above-mentioned spreading, the thickness nonuniformity of the spreading film had arisen at the edge of a laminate. Then, the edge which becomes an oil level and parallel at the time of immersion was cut and removed by width of face of 10cm, respectively, and the edge which becomes an oil level and a perpendicular was cut and removed by width of face of 5cm, respectively.
[0061] Furthermore, the reflective mold conductivity substrate (1) was obtained by forming the ITO film with a thickness of 1000A in one principal plane of this laminate as a conductive layer by sputtering. In addition, the curvature of a substrate, bending, etc. were not produced at all on the occasion of production of a reflective mold conductivity substrate (1).
[0062] When the line coefficient of thermal expansion of the reflective mold conductivity substrate (1) produced as mentioned above was measured, it turned out that they are 1.4x10-5/degree C and a very small value. Moreover, it is Rmax when surface roughness was measured. It was 11nm.
[0063] (Example 2) As it was shown below, the reflective mold conductivity substrate (2) was produced. First, etching processing was performed to copper clad laminate CCL-H860 whose width of face is 1m by 0.1mm in thickness marketed from the Mitsubishi engineering plastics company, copper foil was exfoliated, and the laminate which consists of E glass was produced.
[0064] The reflective mold conductivity substrate (2) was produced like the example 1 except having used this laminate. In addition, the curvature of a substrate, bending, etc. were not produced at all on the occasion of production of a reflective mold conductivity substrate (2).
[0065] When the line coefficient of thermal expansion of the reflective mold conductivity substrate (2) produced as mentioned above was measured, it turned out that they are 1.3x10-5/degree C and a very small value. Moreover, it is Rmax when surface roughness was measured. It was 9nm.
[0066] (Example 3) As it was shown below, the reflective mold conductivity substrate (3) was produced. First, the thermosetting resin constituent which consists of ketone solvent which mixed phenol novolak resin and the epoxy resin of a bisphenol female mold by the weight ratio of 104:168 on the plain-weave fiber cloth T-740 with a thickness of 0.1mm it is thin from E. I. du Pont de Nemours and the Polly p-phenylene phthalamide fiber by the Toray Industries Kevlar company marketed from the SAKAI industrial company, and added latency strengthening catalyst Novacure 3721 by Asahi Chemical Co., Ltd. at 1.5% of the weight of a rate on it was infiltrated. This fiber cloth was dried at 80 degrees C for 1 hour, and two prepregs were produced.
[0067] The laminating of the prepreg of these two sheets is carried out so that MD or the direction of TD of each fiber cloth may cross mutually, and it is 40kg/cm2. The hotpress was performed at a pressure and the temperature of 150 degrees C, and the laminate was produced. In addition, the rate of the resinous principle in the produced laminate was 45 % of the weight, and thickness was 0.17mm.
[0068] The reflective mold conductivity substrate (3) was produced like the example 1 except having used this laminate. In addition, the curvature of a substrate, bending, etc. were not produced at all on the occasion of production of a reflective mold conductivity substrate (3).
[0069] When the line coefficient of thermal expansion of the reflective mold conductivity substrate (3) produced as mentioned above was measured, it turned out that they are 1.1x10-5/degree C and a very small value. Moreover, it is Rmax when surface roughness was measured. It was 7nm.
[0070] Moreover, as it was shown below, the transparence resin substrate (1) used as an opposite substrate of a reflective mold liquid crystal display and (2) were produced.
- Transparence resin substrate (1)
The polyether sulphone film with a thickness of 100 micrometers for optics marketed from the Mitsui Tonosho chemistry company was immersed during the TONEN polysilazane low-temperature baking mold N-L110 type by TONEN CORP. which is the xylene solution which contains low-temperature baking mold annular par hydronalium polysilazane by 20% of the weight of concentration, and this was dried for 30 minutes at the temperature of 80 degrees C. The barrier layer which thickness becomes from the silica which is 0.5 micrometers was formed in both sides of a polyether sulphone film by heating it at the temperature of 150 degrees C further for 2 hours, after making this polyether sulphone film immersed into hydrogen peroxide solution for 4 hours.

[0071] Furthermore, the ITO film with a thickness of 1000A was formed in one principal plane of this polyether sulphone film as a conductive layer by sputtering, and the transparence resin substrate (1) was produced.
[0072] When the line coefficient of thermal expansion of the transparence resin substrate (1) produced as mentioned above was measured, it turned out that they are 5.5x10-5/degree C and a little big value. Moreover, it is Rmax when surface roughness was measured. It was 10nm.
[0073] - Transparence resin substrate (2)
To both sides of the hardening film of the thermosetting arylation polyphenylene ether with a thickness of 100 micrometers marketed from Asahi Chemical Co., Ltd., like the above-mentioned transparence resin substrate (1), the barrier layer which consists of a silica was formed, the ITO film was formed in the principal plane of one of these as a conductive layer, and the transparence resin substrate (2) was produced.
[0074] When the line coefficient of thermal expansion of the transparence resin substrate (2) produced as mentioned above was measured, it turned out that they are 3.5x10-5/degree C and a little big value. Moreover, it is Rmax when surface roughness was measured. It was 8nm.
[0075] The above-mentioned reflective mold conductivity substrate (1) The comparison of weight and thickness was performed about alkali-free-glass substrate OA-2 [with a thickness of 0.7mm] marketed from - (3), a transparence resin substrate (1), (2), and Nippon Electric Glass Co., Ltd. The result is shown in Table 1.
[0076]
[Table 1]

	相対的重量	厚さ（mm）
反射型導電性基板（１）	0.12	0.1
反射型導電性基板（２）	0.13	0.1
反射型導電性基板（３）	0.17	0.2
透明樹脂基板（１）	0.08	0.1
透明樹脂基板（２）	0.07	0.1
ＯＡ－２基板	1	0.7

[0077] In Table 1, the weight of reflective mold conductivity substrate (1) - (3) and a transparence resin substrate (1), and (2) is shown by the relative value to the weight of OA-2 substrate. The reflective mold conductivity substrates and transparence resin substrates of this invention are a light weight and a thin shape compared with a glass substrate so that clearly from Table 1.
[0078] Moreover, reflective mold conductivity substrate [of the above-mentioned examples 1-3] (1) - (3), a transparence resin substrate (1), The transparence resin substrate AMOREX film with a thickness of 100 micrometers which used the polycarbonate as the base film marketed from (2) and a Fujimori industrial company, And measurement of the moisture vapor transmission under 40-degree C temperature and the humidity conditions of 60%RH and oxygen permeability was performed about transparence resin substrate FST-5337 [with a thickness of 100 micrometers which is marketed from Sumitomo Bakelite Co., Ltd. and which used polyether sulphone as the base film]. The result is shown in Table 2.
[0079]
[Table 2]

	水蒸気透過率 (g/m²·day)	酸素透過率 (cc/24hr·atm·m²)
反射型導電性基板（１）	0.5	0.1以下
反射型導電性基板（２）	0.7	0.1以下
反射型導電性基板（３）	0.7	0.1以下
透明樹脂基板（１）	2.7	0.1以下
透明樹脂基板（２）	2.3	0.1以下
ＡＭＯＲＥＸ	11	0.1以下
ＦＳＴ－５３３７	57	1.5

[0080] As shown in Table 2, it turns out that reflective mold conductivity substrate [of examples 1-3] (1) - (3) shows good steam barrier property. Although a transparence resin substrate (1) and (2) have low steam barrier property compared with reflective mold conductivity substrate (1) - (3), they show high steam barrier property as compared with AMOREX and FST-5337.
[0081] Moreover, it turns out that reflective mold conductivity substrate (1) - (3) and a transparence resin substrate (1), and (2) show sufficient oxygen barrier property.
(Example 4) As it was shown below, the reflective mold liquid crystal display was produced.
[0082] First, patterning of the conductive layer of the reflective mold conductivity substrate (2) produced in the example 2 was carried out, and the array electrode substrate was produced. The orientation film was formed by applying the polyimide film to the electrode surface of this array electrode substrate, and performing rubbing processing.
[0083] Next, by applying the polyimide film and performing rubbing processing, the orientation film was formed in the field in which the conductive layer of the above-mentioned transparence resin substrate (2) was formed, and the common electrode substrate was formed in it.
[0084] The spacer which consists of a silica particle was sprinkled, the array electrode substrate and the common electrode substrate were stuck on it using the sealing compound which consists of an epoxy resin, as each electrode surface countered the electrode surface of the array electrode substrate formed as mentioned above, and the liquid crystal cell was produced.
[0085] After pouring in a liquid crystal ingredient from opening of this liquid crystal cell, opening was closed, the polarization film with a thickness of 0.2mm which is from polyvinyl-butyral-iodine on the screen side of a common electrode substrate was stuck, and the 5 inches reflective mold liquid crystal display was produced.
[0086] In addition, the trouble on the process by deformation of the curvature of a reflective mold conductivity substrate, bending, etc.

was not produced on the occasion of production of a reflective mold liquid crystal display. Moreover, even if it carried out the drop test of this reflective mold liquid crystal display from height of 1.5m, breakage did not produce it.

[0087] (Example 5) The 5 inches reflective mold liquid crystal display was produced like the example 4 except having formed the array electrode substrate using the reflective mold conductivity substrate produced in the example 1, and having formed the common electrode substrate using the above-mentioned transparence resin substrate.

[0088] In addition, the trouble on the process by deformation of the curvature of a reflective mold conductivity substrate, bending, etc. was not produced on the occasion of production of a reflective mold liquid crystal display. Moreover, even if it carried out the drop test of this reflective mold liquid crystal display from height of 1.5m, breakage did not produce it.

[0089] (Example 6) The 5 inches reflective mold liquid crystal display was produced like the example 4 except having formed the array electrode substrate using the reflective mold conductivity substrate produced in the example 3.

[0090] In addition, the trouble on the process by deformation of the curvature of a reflective mold conductivity substrate, bending, etc. was not produced on the occasion of production of a reflective mold liquid crystal display. Moreover, even if it carried out the drop test of this reflective mold liquid crystal display from height of 1.5m, breakage did not produce it.

[0091] (Example 7) The reflective mold liquid crystal display was produced like the example 4 except having made size into 7 inches.

[0092] In addition, the trouble on the process by deformation of the curvature of a reflective mold conductivity substrate, bending, etc. was not produced on the occasion of production of size of a reflective mold liquid crystal display as for 7 inches. Moreover, even if it dropped this reflective mold liquid crystal display from height of 1.5m, breakage did not produce it.

[0093] (Example 8) The reflective mold liquid crystal display was produced like the example 5 except having made size into 7 inches.

[0094] In addition, the trouble on the process by deformation of the curvature of a reflective mold conductivity substrate, bending, etc. was not produced on the occasion of production of size of a reflective mold liquid crystal display as for 7 inches. Moreover, even if it dropped this reflective mold liquid crystal display from height of 1.5m, breakage did not produce it.

[0095] (Example 9) The reflective mold liquid crystal display was produced like the example 6 except having made size into 7 inches.

[0096] In addition, the trouble on the process by deformation of the curvature of a reflective mold conductivity substrate, bending, etc. was not produced on the occasion of production of size of a reflective mold liquid crystal display as for 7 inches. Moreover, even if it dropped this reflective mold liquid crystal display from height of 1.5m, breakage did not produce it.

[0097] (Example 1 of a comparison) The liquid crystal cell was produced like the example 4 except having produced the array electrode substrate and the common electrode substrate using the transparence resin substrate AMOREX film with a thickness of 100 micrometers which used the polycarbonate as the base film marketed from the Fujimori industrial company.

[0098] Next, by applying heat-resistant white coating No.4264-2 of 1 acidity or alkalinity by OKITSUMO Co. which made silicone resin distribute a titania, and heating at the temperature of 150 degrees C for 4 hours, the rear face of the electrode surface of the array electrode substrate of this liquid crystal cell was made to harden a coating, and the reflecting layer whose thickness is 5 micrometers was formed in it.

[0099] After pouring in a liquid crystal ingredient from opening of this liquid crystal cell, opening was closed, the polarization film with a thickness of 0.2mm which is from polyvinyl-butyral-iodine on the screen side of a common electrode substrate was stuck, and the 5 inches reflective mold liquid crystal display was produced.

[0100] In addition, on the occasion of production of this reflective mold liquid crystal display, bending of a transparence resin substrate arose at the conveyance process of a substrate, at the seal process, the curvature of a transparence resin substrate arose and the positioning trouble arose. Therefore, the location precision of the produced liquid crystal cell became inadequate.

[0101] Breakage was not produced when this reflective mold liquid crystal display was dropped from height of 1.5m.

(Example 2 of a comparison) The reflective mold liquid crystal display was produced like the example 1 of a comparison except having produced the array electrode substrate and the common electrode substrate using transparence resin substrate FST-5337 [with a thickness of 100 micrometers which is marketed and which used polyether sulphone as the base film] from Sumitomo Bakelite Co., Ltd.

[0102] In addition, also on the occasion of production of this reflective mold liquid crystal display, bending of a transparence resin substrate arose at the conveyance process of a substrate, at the seal process, the curvature of a transparence resin substrate arose and the positioning trouble arose. Therefore, the location precision of the produced liquid crystal cell became inadequate.

[0103] Breakage was not produced when this reflective mold liquid crystal display was dropped from height of 1.5m.

(Example 3 of a comparison) The liquid crystal cell was produced like the example 4 except having produced the array electrode substrate using alkali-free-glass substrate OA-2 [with a thickness of 0.7mm] marketed from Nippon Electric Glass Co., Ltd., and having produced the common electrode substrate using transparence resin substrate FST-5337 [with a thickness of 100 micrometers which is marketed from Sumitomo Bakelite Co., Ltd. and which used polyether sulphone as the base film].

[0104] After pouring in a liquid crystal ingredient from opening of this liquid crystal cell, opening was closed and the polarization film with a thickness of 0.2mm which is from polyvinyl-butyral-iodine on the screen side of a common electrode substrate was stuck.

[0105] Next, white PET with a thickness of 200 micrometers which is marketed from Toray Industries, Inc. and which made PET distribute a titania, and E22 have been arranged as a reflecting layer at the rear face of the electrode surface of the array electrode substrate of this liquid crystal cell, and the 5 inches reflective mold liquid crystal display was produced at it.

[0106] In addition, the trouble on the process by deformation of the curvature of a reflective mold conductivity substrate, bending, etc. was not produced on the occasion of production of a reflective mold liquid crystal display. However, when this reflective mold liquid crystal display was dropped from height of 1.5m, breakage produced it in the array electrode substrate.

[0107] (Example 4 of a comparison) The reflective mold liquid crystal display was produced like the example 3 of a comparison except having produced the common electrode substrate using alkali-free-glass substrate OA-2 [with a thickness of 0.7mm] marketed from Nippon Electric Glass Co., Ltd.

[0108] In addition, the trouble on the process by deformation of the curvature of a reflective mold conductivity substrate, bending, etc. was not produced on the occasion of production of a reflective mold liquid crystal display. However, when this reflective mold liquid crystal display was dropped from height of 1.5m, breakage produced it in the array electrode substrate and the common electrode substrate.

[0109] The comparison of weight and thickness was performed about the reflective mold liquid crystal display of the above-mentioned examples 4-9 and the examples 1-4 of a comparison. The result is shown in Table 3.

[0110]
[Table 3]

	相対的重量	厚さ（mm）
実施例4	0.15	0.5
実施例5	0.17	0.5
実施例6	0.19	0.6
実施例7	0.30	0.5
実施例8	0.34	0.5
実施例9	0.38	0.7
比較例1	0.11	0.7
比較例2	0.10	0.7
比較例3	0.44	1.3
比較例4	1	1.9

[0111] In Table 3, the weight of the reflective mold liquid crystal display of examples 4-9 and the examples 1-3 of a comparison is shown by the relative value to the weight of the reflective mold liquid crystal display of the example 4 of a comparison. Compared with the reflective mold liquid crystal display of the examples 3 and 4 of a comparison, it turns out that the reflective mold liquid crystal display of examples 1-9 is fully lightweight so that clearly from Table 3. Moreover, it turns out that the reflective mold liquid crystal display of examples 4-9 has the reflective mold liquid crystal display of the examples 1 and 2 of a comparison, an EQC, or the thickness not more than it, and it is sharply thin-shape-ized compared with the reflective mold liquid crystal display of the examples 3 and 4 of a comparison.

[Translation done.]

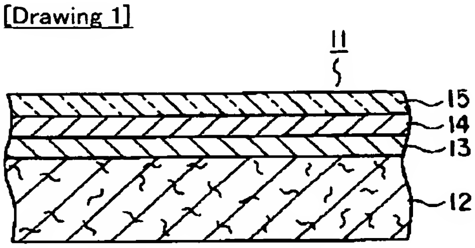
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] One sectional view of the reflective mold conductivity substrate concerning 1 operation gestalt of this invention.
[Drawing 2] One sectional view of the reflective mold conductivity substrate concerning other operation gestalten of this invention.
[Drawing 3] One sectional view of the reflective mold liquid crystal display concerning 1 operation gestalt of this invention.
[Drawing 4] One sectional view of the conventional reflective mold liquid crystal display.
[Drawing 5] One sectional view of the conventional transparence resin substrate.
[Drawing 6] One sectional view of the conventional reflective mold liquid crystal display.
[Drawing 7] One sectional view of the conventional reflective mold liquid crystal display.
[Description of Notations]
11 21 -- Reflective mold conductivity substrate
12 22 -- Laminate
13, 23, 26 -- Reflecting layer
14, 24, 27 -- Barrier layer
15 25 -- Conductive layer
31 -- Reflective mold liquid crystal display
32 -- Reflective mold conductivity substrate
33 -- Transparence resin substrate
34 -- Liquid crystal layer
41, 61, 71 -- Reflective mold liquid crystal display
42, 43, 62, 63, 72, 73 -- Conductive substrate
44, 64, 74 -- Liquid crystal layer
45, 65, 75 -- Light reflex layer
51 -- Conductive substrate
52 -- Heat-resistant transparence resin film
53 -- Anchor coat layer
54 -- Transparent electrode layer
55 -- Barrier layer
56 -- Rebound ace court layer

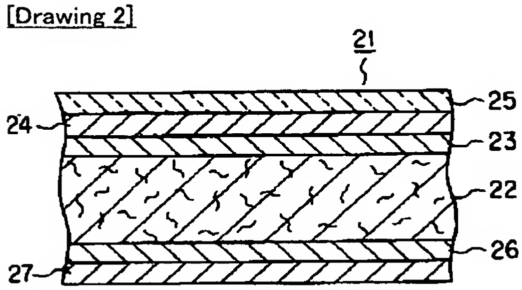
[Translation done.]

DRAWINGS

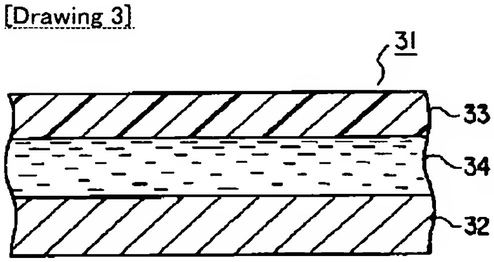
[Drawing 1]



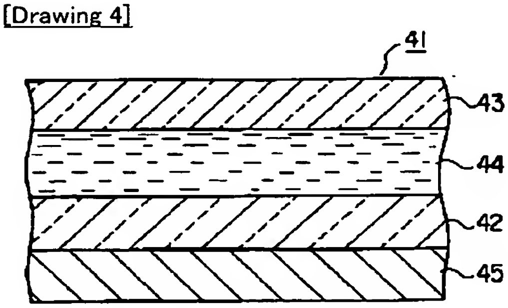
[Drawing 2]



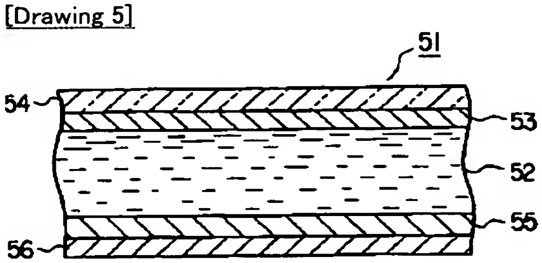
[Drawing 3]



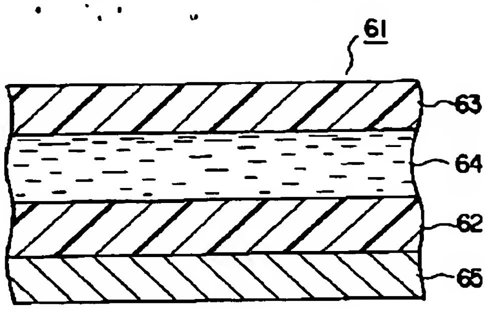
[Drawing 4]



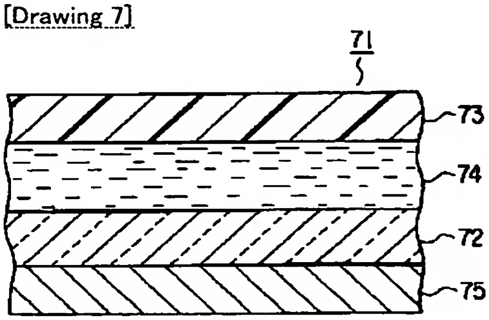
[Drawing 5]



[Drawing 6]



[Drawing 7]



[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) 公開特許公報（A）　(11)特許出願公開番号

特開平11－2812

(43)公開日　平成11年(1999)1月6日

(51)Int.Cl.⁶		識別記号	F I		
G02F	1/1335	520	G02F	1/1335	520
	1/1343			1/1343	
G09F	9/30	310	G09F	9/30	310

審査請求　未請求　請求項の数5　OL　（全 10 頁）

(21)出願番号　特願平9－155456

(22)出願日　平成9年(1997)6月12日

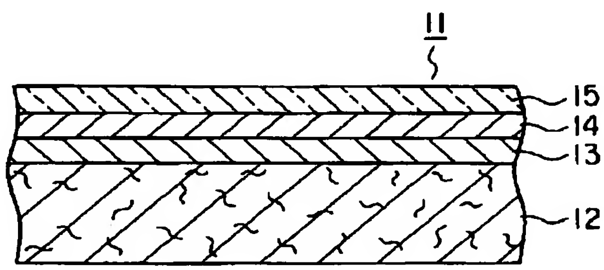
(71)出願人　000003078
株式会社東芝
神奈川県川崎市幸区堀川町72番地

(72)発明者　梶浦　貞夫
神奈川県川崎市幸区小向東芝町１番地　株式会社東芝研究開発センター内

(74)代理人　弁理士　鈴江　武彦　（外６名）

(54)【発明の名称】　反射型導電性基板、反射型液晶表示装置、及び反射型導電性基板の製造方法

(57)【要約】
【課題】薄型・軽量で、十分な耐衝撃性、酸素バリア性、水蒸気バリア性、及び耐スクラッチ性を有し、構成が簡単であり、耐熱性及び剛性が高い反射型導電性基板、反射型液晶表示装置、及び反射型導電性基板の製造方法を提供すること。
【解決手段】本発明の反射型導電性基板１１は、樹脂を含浸させて硬化させた繊維布を含む積層板１２と、白色顔料及び樹脂を含み前記積層板１２上に形成された反射層１３と、シリカを含み前記反射層１３上に形成されたバリア層１４と、前記バリア層１４上に形成された導電層１５とを具備することを特徴とする。



【特許請求の範囲】
【請求項１】　樹脂を含浸させて硬化させた繊維布を含む積層板と、
白色顔料及び樹脂を含み前記積層板上に形成された反射層と、
シリカを含み前記反射層上に形成されたバリア層と、
前記バリア層上に形成された導電層とを具備することを特徴とする反射型導電性基板。
【請求項２】　前記バリア層を構成するシリカが、環状構造を有するポリシラザンから生成されることを特徴とする請求項１に記載の反射型導電性基板。
【請求項３】　前記反射層及びバリア層が、前記積層板の両面に形成されることを特徴とする請求項１または２に記載の反射型導電性基板。
【請求項４】　樹脂を含浸させて硬化させた繊維布を含む積層板と、白色顔料及び樹脂を含み前記積層板上に形成された反射層と、シリカを含み前記反射層上に形成されたバリア層と、前記バリア層上に形成された導電層とを備えた反射型導電性基板と、
前記反射型導電性基板の導電層が形成された面と対向して設けられかつ対向面に透明電極が形成された透明樹脂基板と、
前記反射型導電性基板と透明樹脂基板との間に設けられた液晶層とを具備することを特徴とする反射型液晶表示装置。
【請求項５】　繊維布を芯材とし樹脂を含浸させて硬化させた積層板の一方の主面に白色顔料と熱硬化性樹脂との混合物を塗布・加熱して反射層を形成する工程と、
前記反射層上に環状構造を有するポリシラザンを塗布し熱処理することによりシリカを含むバリア層を形成する工程と、
前記バリア層上に導電層を形成する工程とを具備することを特徴とする反射型導電性基板の製造方法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、反射型導電性基板、反射型液晶表示装置、及び反射型導電性基板の製造方法に係り、特に、携帯情報端末機器に搭載される液晶表示装置等に適した反射型導電性基板、反射型液晶表示装置、及び反射型導電性基板の製造方法に関する。
【０００２】
【従来の技術】近年、衛星通信や移動通信技術の進展に伴い、小型携帯情報端末機器の需要が高まりつつある。携帯情報端末機器の多くに搭載される表示装置には、薄型であることが求められており、液晶表示装置が最も多用されている。
【０００３】また、携帯情報端末機器用の表示装置には、低消費電力であること、外光下での視認性が高いことが要求されるため、透過型液晶表示装置よりも反射型液晶表示装置が多用されている。
【０００４】図４に、従来の反射型液晶表示装置の一断面図を示す。図４で、反射型液晶表示装置４１は、対向して配置され、それぞれの対向面に電極層が形成された、ガラスからなる一対の導電性基板４２、４３と、これら一対の導電性基板４２、４３の間に設けられた液晶層４４と、導電性基板４２の液晶層とは反対側の面に設けられた、白色顔料とＰＥＴとの混合物等からなる光反射層４５とで構成されている。
【０００５】このように、反射型液晶表示装置には、透過型液晶表示装置で一般に用いられるバックライトの代わりに光反射層４５が設けられている。上述の反射型液晶表示装置で用いられる導電性基板は、一般的には、高光透過率、低ヘイズ、及び低リタデーション等の光学的特性を有する厚さ０．７～１．１mmのガラス板上に、透明な導電性材料からなる導電層が形成された透過型導電性基板である。
【０００６】この透過型導電性基板は、耐熱性及び耐薬品性を有するガラス板を用いているので、例えば、液晶表示装置の製造における配向膜の形成や電極形成等のプロセスで行われるフォトエッチングやスパッタリング等の処理に対して、十分な強度を有している。
【０００７】また、導電性基板に要求される、酸素バリア性、水蒸気バリア性、及び耐スクラッチ性等の特性も良好である。しかしながら、上述の透過型導電性基板は、ガラスを用いているため、耐衝撃性が低く、非常に重い。基板を軽量化するために、ガラス板の厚さを薄くした場合、耐衝撃性がさらに低下してしまうため、軽量化が困難である。したがって、高い耐衝撃性及び軽量であることが求められている小型携帯情報端末機器では、プラスチック等の樹脂フィルムを導電性基板に用いることが検討されている。
【０００８】図５に、従来の樹脂フィルムを用いた導電性基板の一断面図を示す。図５で、導電性基板５１は、耐熱性透明樹脂フィルム５２の一方の主面に、アンカーコート層５３及び透明電極層５４が順次積層され、耐熱性透明樹脂フィルム５２の他方の主面に、バリア層５５及びハードコート層５６が順次積層されて構成されている。
【０００９】樹脂フィルムを用いた導電性基板は、ガラス板とは異なり、割れることなく軽量である。しかしながら、一般に、酸素バリア性、水蒸気バリア性、及び耐スクラッチ性等の機能の全てを、単一の樹脂に負担させることはできない。そのため、樹脂フィルムを用いた導電性基板５１では、酸素バリア性及び水蒸気バリア性を有するバリア層５５、及び耐スクラッチ性を有するハードコート層５６が必要となる。
【００１０】また、耐熱性樹脂フィルム５２には、直接、透明電極層５４を成膜することができない。そのため、耐熱性樹脂フィルム５２と透明電極層５４との間にアンカーコート層５３を設ける必要がある。

【００１１】なお、図５では、バリア層５５は、酸素バリア性及び水蒸気バリア性を有する単一層となっているが、酸素バリア性と水蒸気バリア性とを単一の樹脂に付与することは非常に困難であるため、通常、バリア層５５は、酸素バリア性を有する層と、水蒸気バリア性を有する層とを積層した２層構造により構成される。しかしながら、一般に、水蒸気バリア性を有する樹脂は、表面エネルギーが高く、他の樹脂との馴染みが低い。そのため、水蒸気バリア性を有する樹脂に、他の樹脂を接着させるためには、表面処理を施す必要がある。

【００１２】このように、樹脂フィルムを用いた導電性基板の製造では、膨大な数の樹脂層を積層する必要があり、多くの工程を必要とするため、製造工程が複雑になるという問題を生じてしまう。

【００１３】また、樹脂フィルムを用いた導電性基板は、線熱膨張係数が大きく、熱膨張率の異なる複数の樹脂層を積層することにより形成されるため、加熱プロセスの際に、基板の反り等が生じ易く、熱寸法安定性等の耐熱性が低い。さらに、この導電性基板は、剛性が乏しいため、上述の反りや撓み等の基板の変形が容易に生じる。

【００１４】そのため、図６に示すように、一対の導電性基板６２、６３の両方を樹脂で構成すると、液晶表示装置の製造の際、基板の位置合わせ等が困難になるという問題を生ずる。この問題は、アレイ電極を形成する場合は、より高温のプロセスが必用となるため、特に顕著となる。

【００１５】また、図７に示すように、一対の導電性基板７２、７３のうち、一方の導電性基板７２をガラスで構成し、他方の導電性基板７３を樹脂で構成すると、上述の基板の位置合わせ等の問題は生じない。しかしながら、ガラスを用いているため、耐衝撃性が低く、軽量化が困難になるという問題を生ずる。

【００１６】

【発明が解決しようとする課題】上述のように、従来の反射型液晶表示装置で用いられる導電性基板は、基板の軽量化、及び十分な耐衝撃性、酸素バリア性、水蒸気バリア性、及び耐スクラッチ性を得るために、構成が複雑になり基板の製造に多くの工程を必要とした。また、耐熱性及び剛性が低いため、反りや撓み等の変形が生じ易く、表示装置の製造等が困難であった。

【００１７】本発明は、薄型・軽量で、十分な耐衝撃性、酸素バリア性、水蒸気バリア性、及び耐スクラッチ性を有し、構成が簡単であり、耐熱性及び剛性が高い反射型導電性基板、反射型液晶表示装置、及び反射型導電性基板の製造方法を提供することを目的とする。

【００１８】

【課題を解決するための手段】本発明は、樹脂を含浸させて硬化させた繊維布を含む積層板と、白色顔料及び樹脂を含み前記積層板上に形成された反射層と、シリカを含み前記反射層上に形成されたバリア層と、前記バリア層上に形成された導電層とを具備することを特徴とする反射型導電性基板を提供する。

【００１９】本発明は、上記反射型導電性基板において、前記バリア層を構成するシリカが、環状構造を有するポリシラザンから生成されることを特徴とする。本発明は、上記反射型導電性基板において、前記反射層及びバリア層が、前記積層板の両面に形成されることを特徴とする。

【００２０】また、本発明は、樹脂を含浸させて硬化させた繊維布を含む積層板と、白色顔料及び樹脂を含み前記積層板上に形成された反射層と、シリカを含み前記反射層上に形成されたバリア層と、前記バリア層上に形成された導電層とを備えた反射型導電性基板と、前記反射型導電性基板の導電層が形成された面と対向して設けられかつ対向面に透明電極が形成された透明樹脂基板と、前記反射型導電性基板と透明樹脂基板との間に設けられた液晶層とを具備することを特徴とする反射型液晶表示装置を提供する。

【００２１】さらに、本発明は、繊維布を芯材とし樹脂を含浸させて硬化させた積層板の一方の主面に白色顔料と熱硬化性樹脂との混合物を塗布・加熱して反射層を形成する工程と、前記反射層上に環状構造を有するポリシラザンを塗布し熱処理することによりシリカを含むバリア層を形成する工程と、前記バリア層上に導電層を形成する工程とを具備することを特徴とする反射型導電性基板の製造方法を提供する。

【００２２】

【発明の実施の形態】以下、本発明の実施の形態について、図面を参照しながら、より詳細に説明する。図１に、本発明の一実施形態に係る反射型導電性基板の一断面図を示す。

【００２３】図１で、反射型導電性基板１１は、熱硬化性樹脂を含浸させた繊維布からなる積層板１２の一方の主面に、白色顔料及び樹脂を含む反射層１３、シリカからなるバリア層１４、及び導電層１５を順次積層して構成されている。

【００２４】本発明の反射型導電性基板で用いられる積層板は、熱硬化性樹脂を含浸させた繊維布からなるが、用いられる繊維布の材料としては、Ｅガラス、Ｄガラス、及びＳガラス等のガラスや、芳香族ポリアミド等の樹脂等のフィラメントを挙げることができる。

【００２５】このフィラメントの径は、２０μm以下であることが好ましい。２０μm以下の径のフィラメントを用いることにより、反射型導電性基板を薄型化及び軽量化することができ、基板の機械的強度を高めることができる。

【００２６】これらフィラメントを繊維布とする場合、織らずに不織布として用いることもできるが、平織り、朱子織り、及び綾織り等の織り方で織り、織布として用

いることが好ましい。また、繊維布の厚さは、３０～１００μmであることが好ましく、３０～５０μmであることがより好ましい。繊維布の厚さが、上記範囲内にある場合、反射型導電性基板を薄型化及び軽量化することができ、基板の機械的強度を高めることができる。

【００２７】なお、フィラメントの織り方に応じて、作製される繊維布の表面粗度が変化する。同じフィラメントを用いて繊維布を作製した場合、表面粗度は、綾織り、朱子織り、平織りの順に高くなるが、バリア層を十分な厚さで形成することにより、基板表面を平滑化することができる。

【００２８】また、繊維布を平織りで作製する場合、後述の樹脂の繊維布への含浸が容易になり、積層板の製造コストを低減することができる。以上説明した繊維布には、熱硬化性樹脂が含浸される。繊維布への含浸に用いられる樹脂としては、フェノール樹脂－エポキシ樹脂混合物、ビスマレイミド－トリアジン樹脂混合物等の耐熱性の高い熱硬化性樹脂を挙げることができる。フェノール樹脂として、フェノールノボラック樹脂を用い、エポキシ樹脂として、ビスフェノール型のエポキシ樹脂を用いると、高い耐熱性を得ることができるので、特に好ましい。

【００２９】ビスマレイミドとしては、ジアミノジフェニルメタンから誘導されるものを用いることができるが、ジアミノジフェニルメタンのフェニル基がアルキル基で置換された化合物から誘導されるものを用いてもよい。また、トリアジン樹脂は、ビスフェノールＡと塩化シアンとの脱塩酸反応により得ることができる。なお、これらのビスマレイドートリアジン樹脂混合物としては、三菱エンジニアリングプラスチックス社から、エポキシ樹脂等が添加されたＢＴレジンとして市販されているものを用いることができる。

【００３０】本発明の反射型導電性基板で用いられる積層板は、以下に示すようにして製造される。まず、上述の熱硬化性樹脂組成物をケトン系溶媒等の有機溶媒に溶かし、前述の繊維布に含浸させる。これを、一次乾燥させてプリプレグを作製し、Ｂステージ化する。このプリプレグを、例えば、２枚重ね、ホットプレスを用いて、１５０～１８０℃程度に加熱しながら、２０～６０kg／cm^2 程度の圧力で加圧する。さらに、これを１５０～１８０℃程度に加熱して、熱硬化性樹脂を硬化させることにより、積層板を得る。積層板中の樹脂成分の割合は、４０～６０重量％に制御されることが好ましい。

【００３１】以上のようにして製造される積層板は、繊維布を２枚重ねた構成であるが、軽量かつ薄型で、十分な機械的強度を得ることができれば、積層数に特に制限はない。しかしながら、積層板の異方性を抑制するために、積層板は、繊維布を偶数枚重ねた構成とすることが好ましく、軽量化の観点から２枚重ねた構成とすることが最も好ましい。

【００３２】この積層板の厚さは、５０～２００μmであることが好ましく、５０～１００μmであることがより好ましい。積層板の厚さが、上記範囲内にある場合、反射型導電性基板を薄型化及び軽量化することができ、基板の機械的強度を高めることができる。

【００３３】また、本発明の反射型導電性基板で用いられる積層板として、積層板メーカから市販されている、表面に金属箔が張られた積層板を用いてもよい。なお、このような市販されている積層板に張られた金属箔は、エッチングにより容易に除去することができる。

【００３４】本発明の反射型導電性基板で、反射層に用いられる白色顔料として、例えば、チタニアのような一般的に用いられる白色顔料を挙げることができる。この白色顔料を、ＢＴＸ溶媒中に分散された熱硬化性のシリコーン樹脂に分散させ、これを積層板に塗布・乾燥し、さらに加熱することにより、反射層が形成される。

【００３５】このとき、シリコーン樹脂に対する白色顔料の重量比（Ｐ／Ｒ比）は、２．５～６であることが好ましく、４～６であることがより好ましい。Ｐ／Ｒ比が上記下限値以上である場合、反射型導電性基板を構成する各層の線熱膨張係数を低くして、基板の熱寸法安定性を向上させることができる。しかしながら、Ｐ／Ｒ比が上記上限値を超えると、白色顔料の分散が困難になる。

【００３６】この反射層の厚さは、５～１０μmであることが好ましい。反射層の厚さが、この範囲内にある場合、反射型導電性基板の厚さや重量を大きく増加させることなく、積層板の色を白色で隠蔽し、かつ表面粗度をある程度までは低減することができる。

【００３７】本発明の反射型導電性基板のバリア層は、シリカで構成することができる。このバリア層を構成するシリカは、ポリシラザンから得ることが好ましい。ポリシラザンとは、一般式$H_3Si(NHSiH_2)_nNHSiH_3$ に示す直鎖状のシラザンや一般式$(SiH_2NH)_n$ に示すシクロシラザンを骨格とする多量体である。これらポリシラザンを所定の処理により加水分解・重縮合すると、ポリシラザンのＳｉ－Ｎ結合が断たれＳｉ－Ｏ結合を生じ、シリカ及びアンモニアを生ずる。したがって、ポリシラザンが珪素原子に結合する水素原子を有する場合は、生成するシリカ中にも珪素原子に結合する水素原子が残留するのである。

【００３８】ポリシラザンとして、東燃社から市販されている東燃ポリシラザン低温焼成型Ｎ－Ｌ１１０タイプ等の、Ｐｄ錯体が触媒として添加された環状パーヒドロポリシラザン等の環状構造を有する低温焼成型のポリシラザンを用いると、１００～１５０℃程度の比較的低い温度で加熱することにより、ポリシラザンをシリカに変えることができるので、好ましい。

【００３９】特に、環状構造を有する低温焼成型のポリシラザンとして、縮合環構造を有するポリシラザンを用いると、反応生成物であるシリカ中で、珪素原子に結合

する水素原子の割合が減少し、１つの珪素原子に結合する酸素原子の数が増加するため、強固かつ緻密なバリア層を形成することができる。

【００４０】上述のポリシラザンを用いたバリア層の形成は、例えば、以下のようにして行うことができる。まず、ポリシラザンのキシレン溶液を、積層板上に形成された反射層上に塗布・乾燥し、過酸化水素水中に２～４時間程度浸漬させる。次に、積層板を過酸化水素水から引き上げ、１００～１５０℃程度の温度で１～４８時間加熱することにより、シリカで構成されるバリア層が形成される。

【００４１】一般には、シリカからなる層は、蒸着法やゾル・ゲル法で形成することも可能である。しかしながら、蒸着法では、十分な厚さの膜を形成することが困難であり、例え、形成したとしてもクラックやピンホールが生じてしまう。また、ゾル・ゲル法では、アルコキシドを酸化物へと変化させるためには、非常に高い温度での加熱を必要とする。したがって、樹脂を用いた基板には適用することができない。

【００４２】それに対し、上述のポリシラザンを用いると、１００～１５０℃程度の比較的低い温度で、十分な厚さのシリカ膜を得ることができるのである。このようにして形成されるバリア層の厚さは、０．５～２μmであることが好ましく、１．５～２μmであることがより好ましい。バリア層の厚さが上記範囲内にある場合、反射型導電性基板の厚さや重量を大きく増加させることなく、十分な酸素バリア性及び水蒸気バリア性を得ることができる。また、上述の反射層では、表面粗度を十分には低減することができないが、バリア層の厚さが上記下限値以上の場合は、基板の表面粗度を十分に低減することが可能となる。

【００４３】本発明の反射型導電性基板で、導電層に用いられる材料としては、$In_2O_3-SnO_2$ 混合物（ＩＴＯ）、$TiO_2/Ag/TiO_2$、BiO_3、SnO_2（Ｆ）、$CdSnO_3$、$V_2O_5 \cdot nH_2O$等の透明な導電性材料を挙げることができる。この導電層の厚さは、５００～３０００オングストロームの厚さで形成されることが好ましい。

【００４４】本発明の反射型導電性基板は、反射層及びバリア層が、積層板の両面に形成されていてもよい。図２に、本発明の他の実施形態に係る反射型導電性基板の一断面図を示す。

【００４５】図２で、反射型導電性基板２１は、積層板２２の一方の主面に、反射層２３、バリア層２４、及び導電層２５が順次積層され、他方の主面には、反射層２６及びバリア層２７が順次積層されて構成されている。

【００４６】このように、反射型導電性基板を、積層板に対して対称になるように構成すると、積層板の２つの主面での熱膨張率が等しくなり、加熱された場合でも、反り等の変形が生じにくい。

【００４７】図３に、上述した反射型導電性基板を具備する反射型液晶表示装置の一断面図を示す。図３で、反射型液晶表示装置３１は、反射型導電性基板３２と、この反射型導電性基板３２の導電層（図示せず）が形成された面と対向して設けられ、対向面に透明電極（図示せず）が形成された透明樹脂基板３３と、反射型導電性基板３２と透明樹脂基板３３との間に設けられた液晶層３４とで構成されている。

【００４８】このように構成される反射型液晶表示装置で用いられる透明樹脂基板３３としては、図５に示すような、従来から用いられている通常の透明樹脂基板を用いることができる。この透明樹脂基板は、前述のように、耐熱性透明樹脂フィルムの一方の主面に、アンカーコート層及び透明電極層が順次積層され、耐熱性透明樹脂フィルムの他方の主面に、バリア層及びハードコート層が順次積層されて構成されている。

【００４９】この透明樹脂基板に用いられる耐熱性透明樹脂フィルムの材料としては、ポリカーボネート、ポリアリレート、及びポリエーテルスルホンや、日本合成ゴム社からＡＲＴＯＮとして市販されているノルボルネン系樹脂や、旭化成社からＡ－ＰＰＥとして市販されている熱硬化型アリル化ポリフェニレンエーテル等を挙げることができる。

【００５０】また、この透明樹脂基板に用いられるバリア層にも、酸素バリア性及び水蒸気バリア性が要求されるが、一般に、これらの機能を同時に有する樹脂は、ハロゲン原子を含む樹脂以外知られていない。しかしながら、ハロゲン原子を含む樹脂を用いた場合、遊離ハロゲンイオンが液晶層中に混入し、装置の特性に悪影響を与えてしまう。したがって、通常は、バリア層を、酸素バリア性を有する樹脂膜と、水蒸気バリア性を有する樹脂膜とを重ねた複合膜で構成する。

【００５１】この透明樹脂基板を構成する酸素バリア性を有する樹脂としては、ナイロン及びエチレン－ビニルアルコール共重合体等を挙げることができ、水蒸気バリア性を有する樹脂としては、ポリエチレン等を挙げることができる。これらの樹脂膜は、５～１０μmの厚さであることが好ましい。厚さが１０μmを超えると、透明樹脂基板の光透過率が低下し、厚さが５μm未満の場合は、バリア性が不十分となる。

【００５２】この透明樹脂基板で用いられるハードコート層を、ウレタン樹脂、シリコーン樹脂、及びアクリル樹脂等で構成すると、十分な耐スクラッチ性を得ることができる。また、アンカーコート層は、通常、アクリル樹脂等のプライマーやカップリング剤等で構成される。

【００５３】なお、透明樹脂基板として、上述の耐熱性透明樹脂フィルムの少なくとも一方の主面に、反射型導電性基板について説明したのと同様のシリカからなるバリア層が形成されたものを用いることが好ましい。このように透明樹脂基板を構成すると、簡単な構成で高いバ

リア性を得ることができ、反射型液晶表示装置を、より薄型・軽量化することができる。

【0054】このバリア層の厚さは、0．3～2．0μmであることが好ましく、0．3～1．0μmであることがより好ましい。また、このバリア層を、耐熱性透明樹脂フィルムの両面に形成すると、バリア性がさらに高くなり、好ましい。

【0055】本発明の反射型液晶表示装置で、液晶層は、通常の反射型液晶表示装置で用いられるのと同様の液晶材料で構成される。以上、本発明の反射型導電性基板を、反射型液晶表示装置に用いるものとして説明したが、例えば、エレクトロルミネッセンスを用いた表示装置等にも適用することが可能である。

【0056】

【実施例】以下、本発明の実施例について説明する。

（実施例1）以下に示すようにして、反射型導電性基板（1）を作製した。

【0057】まず、東芝ケミカル社から市販されている厚さ0．1mmで幅が1mのガラスエポキシ銅張積層板TLC551Mに、エッチング処理を施して銅箔を剥離し、Eガラスからなる積層板を作製した。

【0058】この積層板に、チタニアをシリコーン樹脂に分散させた、オキツモ社製の一液性の耐熱性白色塗料No．4264－2を含浸させて、積層板の両面に白色塗料を塗付した。これを150℃の温度で、4時間加熱することにより、塗料を硬化させ、積層板の中央部で厚さが5μmの反射層を積層板の両面に形成した。

【0059】次に、この積層板を、東燃社製の低温焼成型環状パーヒドロポリシラザンを20重量％の濃度で含有するキシレン溶液、東燃ポリシラザン低温焼成型N－L110タイプ中に浸漬し、これを80℃の温度で、30分間乾燥した。この積層板を、過酸化水素水中に4時間浸漬させた後、さらに、150℃の温度で、2時間加熱することにより、積層板の両面に形成された反射層上に、積層板の中央部で厚さが1．7μmのシリカからなるバリア層を形成した。

【0060】なお、上述の塗布において浸漬塗布法を採用したため、積層板の端部で、塗布膜の膜厚ムラが生じていた。そこで、浸漬時に液面と平行になる端部をそれぞれ10cmの幅で切断・除去し、液面と垂直になる端部をそれぞれ5cmの幅で切断・除去した。

【0061】さらに、この積層板の一方の主面に、スパッタリングにより厚さ1000オングストロームのITO膜を導電層として形成することにより、反射型導電性基板（1）を得た。なお、反射型導電性基板（1）の作製の際に、基板の反りや撓み等は全く生じなかった。

【0062】以上のようにして作製した反射型導電性基板（1）の線熱膨張係数を測定したところ、1．4×10^{-5}／℃と極めて小さな値であることが分かった。また、表面粗度を測定したところ、R_{max} が11nmであった。

【0063】（実施例2）以下に示すようにして、反射型導電性基板（2）を作製した。まず、三菱エンジニアリングプラスチックス社から市販されている厚さ0．1mmで幅が1mの銅張積層板CCL－H860に、エッチング処理を施して銅箔を剥離し、Eガラスからなる積層板を作製した。

【0064】この積層板を用いたこと以外は実施例1と同様にして、反射型導電性基板（2）を作製した。なお、反射型導電性基板（2）の作製の際に、基板の反りや撓み等は全く生じなかった。

【0065】以上のようにして作製した反射型導電性基板（2）の線熱膨張係数を測定したところ、1．3×10^{-5}／℃と極めて小さな値であることが分かった。また、表面粗度を測定したところ、R_{max} が9nmであった。

【0066】（実施例3）以下に示すようにして、反射型導電性基板（3）を作製した。まず、サカイ産業社から市販されている、デュポン・東レ・ケブラー社製のポリ－p－フェニレンフタルアミド繊維からなる厚さ0．1mmの平織り繊維布T－740に、フェノールノボラック樹脂とビスフェノールF型のエポキシ樹脂を104：168の重量比で混合し旭化成社製の潜在性強化触媒ノバキュア3721を1．5重量％の割合で添加したケトン系溶媒からなる熱硬化性樹脂組成物を含浸させた。この繊維布を80℃で1時間乾燥してプリプレグを2枚作製した。

【0067】これら2枚のプリプレグを、それぞれの繊維布のMDまたはTD方向が互いに交差するように積層し、40kg／cm^2 の圧力、150℃の温度でホットプレスを行い、積層板を作製した。なお、作製された積層板中の樹脂成分の割合は45重量％であり、厚さは0．17mmであった。

【0068】この積層板を用いたこと以外は実施例1と同様にして、反射型導電性基板（3）を作製した。なお、反射型導電性基板（3）の作製の際に、基板の反りや撓み等は全く生じなかった。

【0069】以上のようにして作製した反射型導電性基板（3）の線熱膨張係数を測定したところ、1．1×10^{-5}／℃と極めて小さな値であることが分かった。また、表面粗度を測定したところ、R_{max} が7nmであった。

【0070】また、以下に示すようにして、反射型液晶表示装置の対向基板として用いられる透明樹脂基板（1）、（2）を作製した。

・透明樹脂基板（1）

三井東庄化学社から市販されている、厚さ100μmの光学用のポリエーテルスルホンフィルムを、低温焼成型環状パーヒドロポリシラザンを20重量％の濃度で含有するキシレン溶液である東燃社製の東燃ポリシラザン低

温焼成型Ｎ－Ｌ１１０タイプ中に浸漬し、これを８０℃の温度で、３０分間乾燥した。このポリエーテルスルホンフィルムを、過酸化水素水中に４時間浸漬させた後、さらに、１５０℃の温度で、２時間加熱することにより、ポリエーテルスルホンフィルムの両面に厚さが０．５μｍのシリカからなるバリア層を形成した。

【００７１】さらに、このポリエーテルスルホンフィルムの一方の主面に、スパッタリングにより厚さ１０００オングストロームのＩＴＯ膜を導電層として形成して、透明樹脂基板（１）を作製した。

【００７２】以上のようにして作製した透明樹脂基板（１）の線熱膨張係数を測定したところ、５．５×１０$^{-5}$／℃とやや大きな値であることが分かった。また、表面粗度を測定したところ、R_{max} が１０ｎｍであった。

【００７３】・透明樹脂基板（２）
旭化成社から市販されている、厚さ１００μｍの熱硬化性アリル化ポリフェニレンエーテルの硬化フィルムの両面に、上記透明樹脂基板（１）と同様にして、シリカからなるバリア層を形成し、その一方の主面にＩＴＯ膜を導電層として形成して、透明樹脂基板（２）を作製した。

【００７４】以上のようにして作製した透明樹脂基板（２）の線熱膨張係数を測定したところ、３．５×１０$^{-5}$／℃とやや大きな値であることが分かった。また、表面粗度を測定したところ、R_{max} が８ｎｍであった。

【００７５】上記反射型導電性基板（１）～（３）、透明樹脂基板（１）、（２）、及び日本電気硝子社から市販されている、厚さ０．７ｍｍの無アルカリガラス基板＊＊ＯＡ－２について、重量と厚さの比較を行った。表１に、その結果を示す。

【００７６】

【表１】

	相対的重量	厚さ（mm）
反射型導電性基板（１）	0.12	0.1
反射型導電性基板（２）	0.13	0.1
反射型導電性基板（３）	0.17	0.2
透明樹脂基板（１）	0.08	0.1
透明樹脂基板（２）	0.07	0.1
ＯＡ－２基板	1	0.7

【００７７】表１で、反射型導電性基板（１）～（３）及び透明樹脂基板（１）、（２）の重量は、ＯＡ－２基板の重量に対する相対値で示されている。表１から明らかなように、本発明の反射型導電性基板及び透明樹脂基板は、ガラス基板に比べて、軽量・薄型である。

【００７８】また、上記実施例１～３の反射型導電性基板（１）～（３）、透明樹脂基板（１）、（２）、藤森工業社から市販されている、ポリカーボネートをベースフィルムとした厚さ１００μｍの透明樹脂基板ＡＭＯＲＥＸフィルム、及び住友ベークライト社から市販されている、ポリエーテルスルホンをベースフィルムとした厚さ１００μｍの透明樹脂基板ＦＳＴ－５３３７について、４０℃の温度及び６０％ＲＨの湿度条件下での水蒸気透過率及び酸素透過率の測定を行った。表２に、その結果を示す。

【００７９】

【表２】

	水蒸気透過率 (g/m²·day)	酸素透過率 (cc/24hr·atm·m²)
反射型導電性基板（１）	0.5	0.1以下
反射型導電性基板（２）	0.7	0.1以下
反射型導電性基板（３）	0.7	0.1以下
透明樹脂基板（１）	2.7	0.1以下
透明樹脂基板（２）	2.3	0.1以下
ＡＭＯＲＥＸ	11	0.1以下
ＦＳＴ－５３３７	57	1.5

【００８０】表２に示すように、実施例１～３の反射型導電性基板（１）～（３）は、良好な水蒸気バリア性を示していることが分かる。透明樹脂基板（１）、（２）は、反射型導電性基板（１）～（３）に比べると、水蒸気バリア性が低いが、ＡＭＯＲＥＸ及びＦＳＴ－５３３７と比較すると、高い水蒸気バリア性を示している。

【００８１】また、反射型導電性基板（１）～（３）及び透明樹脂基板（１）、（２）は、十分な酸素バリア性を示していることが分かる。

（実施例４）以下に示すようにして、反射型液晶表示装置を作製した。

【００８２】まず、実施例２で作製した反射型導電性基板（２）の導電層をパターニングして、アレイ電極基板を作製した。このアレイ電極基板の電極面に、ポリイミド膜を塗布し、ラビング処理を施すことにより、配向膜を形成した。

【００８３】次に、上記透明樹脂基板（２）の導電層が形成された面に、ポリイミド膜を塗布し、ラビング処理を施すことにより、配向膜を形成して、コモン電極基板を形成した。

【００８４】以上のようにして形成したアレイ電極基板の電極面に、シリカ微粒子からなるスペーサを散布し、アレイ電極基板とコモン電極基板とを、それぞれの電極面が対向するようにして、エポキシ樹脂からなるシール剤を用いて貼り合せて液晶セルを作製した。

【００８５】この液晶セルの開口部から液晶材料を注入

した後、開口部を封止し、コモン電極基板の表示面側に、ポリビニルブチラール－ヨウ素からなる厚さ０．２ｍｍの偏光フィルムを貼り付けて、５インチの反射型液晶表示装置を作製した。

【００８６】なお、反射型液晶表示装置の作製の際に、反射型導電性基板の反りや撓み等の変形による工程上のトラブルは生じなかった。また、この反射型液晶表示装置は、１．５ｍの高さから落下試験させても、破損が生じなかった。

【００８７】（実施例５）アレイ電極基板を、実施例１で作製した反射型導電性基板を用いて形成し、コモン電極基板を、上記透明樹脂基板を用いて形成したこと以外は、実施例４と同様にして、５インチの反射型液晶表示装置を作製した。

【００８８】なお、反射型液晶表示装置の作製の際に、反射型導電性基板の反りや撓み等の変形による工程上のトラブルは生じなかった。また、この反射型液晶表示装置は、１．５ｍの高さから落下試験させても、破損が生じなかった。

【００８９】（実施例６）アレイ電極基板を、実施例３で作製した反射型導電性基板を用いて形成したこと以外は、実施例４と同様にして、５インチの反射型液晶表示装置を作製した。

【００９０】なお、反射型液晶表示装置の作製の際に、反射型導電性基板の反りや撓み等の変形による工程上のトラブルは生じなかった。また、この反射型液晶表示装置は、１．５ｍの高さから落下試験させても、破損が生じなかった。

【００９１】（実施例７）サイズを７インチとしたこと以外は、実施例４と同様にして、反射型液晶表示装置を作製した。

【００９２】なお、サイズを７インチにしても、反射型液晶表示装置の作製の際に、反射型導電性基板の反りや撓み等の変形による工程上のトラブルは生じなかった。また、この反射型液晶表示装置は、１．５ｍの高さから落下させても、破損が生じなかった。

【００９３】（実施例８）サイズを７インチとしたこと以外は、実施例５と同様にして、反射型液晶表示装置を作製した。

【００９４】なお、サイズを７インチにしても、反射型液晶表示装置の作製の際に、反射型導電性基板の反りや撓み等の変形による工程上のトラブルは生じなかった。また、この反射型液晶表示装置は、１．５ｍの高さから落下させても、破損が生じなかった。

【００９５】（実施例９）サイズを７インチとしたこと以外は、実施例６と同様にして、反射型液晶表示装置を作製した。

【００９６】なお、サイズを７インチにしても、反射型液晶表示装置の作製の際に反射型導電性基板の反りや撓み等の変形による工程上のトラブルは生じなかった。また、この反射型液晶表示装置は、１．５ｍの高さから落下させても、破損が生じなかった。

【００９７】（比較例１）藤森工業社から市販されている、ポリカーボネートをベースフィルムとした厚さ１００μｍの透明樹脂基板ＡＭＯＲＥＸフィルムを用いてアレイ電極基板及びコモン電極基板を作製したこと以外は、実施例４と同様にして液晶セルを作製した。

【００９８】次に、この液晶セルのアレイ電極基板の電極面の裏面に、チタニアをシリコーン樹脂に分散させた、オキツモ社製の一液性の耐熱性白色塗料Ｎｏ．４２６４－２を塗布し、１５０℃の温度で、４時間加熱することにより、塗料を硬化させ、厚さが５μｍの反射層を形成した。

【００９９】この液晶セルの開口部から液晶材料を注入した後、開口部を封止し、コモン電極基板の表示面側に、ポリビニルブチラール－ヨウ素からなる厚さ０．２ｍｍの偏光フィルムを貼り付けて、５インチの反射型液晶表示装置を作製した。

【０１００】なお、この反射型液晶表示装置の作製の際に、基板の搬送工程で透明樹脂基板の撓みが生じ、シール工程では透明樹脂基板の反りが生じて、位置決めトラブルが生じた。そのため、作製された液晶セルの位置精度が不十分となった。

【０１０１】この反射型液晶表示装置を、１．５ｍの高さから落下させたところ、破損は生じなかった。

（比較例２）住友ベークライト社から市販されている、ポリエーテルスルホンをベースフィルムとした厚さ１００μｍの透明樹脂基板ＦＳＴ－５３３７を用いてアレイ電極基板及びコモン電極基板を作製したこと以外は、比較例１と同様にして反射型液晶表示装置を作製した。

【０１０２】なお、この反射型液晶表示装置の作製の際にも、基板の搬送工程で透明樹脂基板の撓みが生じ、シール工程では透明樹脂基板の反りが生じて、位置決めトラブルが生じた。そのため、作製された液晶セルの位置精度が不十分となった。

【０１０３】この反射型液晶表示装置を、１．５ｍの高さから落下させたところ、破損は生じなかった。

（比較例３）日本電気硝子社から市販されている、厚さ０．７ｍｍの無アルカリガラス基板ＯＡ－２を用いてアレイ電極基板を作製し、住友ベークライト社から市販されている、ポリエーテルスルホンをベースフィルムとした厚さ１００μｍの透明樹脂基板ＦＳＴ－５３３７を用いてコモン電極基板を作製したこと以外は、実施例４と同様にして液晶セルを作製した。

【０１０４】この液晶セルの開口部から液晶材料を注入した後、開口部を封止し、コモン電極基板の表示面側に、ポリビニルブチラール－ヨウ素からなる厚さ０．２ｍｍの偏光フィルムを貼り付けた。

【０１０５】次に、この液晶セルのアレイ電極基板の電極面の裏面に、東レ社から市販されている、チタニアを

ＰＥＴに分散させた厚さ２００μｍの白ＰＥＴ、Ｅ２２を反射層として配置して、５インチの反射型液晶表示装置を作製した。

【０１０６】なお、反射型液晶表示装置の作製の際に、反射型導電性基板の反りや撓み等の変形による工程上のトラブルは生じなかった。しかしながら、この反射型液晶表示装置を、１．５ｍの高さから落下させたところ、アレイ電極基板に破損が生じた。

【０１０７】（比較例４）日本電気硝子社から市販されている、厚さ０．７ｍｍの無アルカリガラス基板ＯＡ－２を用いてコモン電極基板を作製したこと以外は、比較例３と同様にして反射型液晶表示装置を作製した。

【０１０８】なお、反射型液晶表示装置の作製の際に、反射型導電性基板の反りや撓み等の変形による工程上のトラブルは生じなかった。しかしながら、この反射型液晶表示装置を、１．５ｍの高さから落下させたところ、アレイ電極基板及びコモン電極基板に破損が生じた。

【０１０９】上記実施例４～９及び比較例１～４の反射型液晶表示装置について、重量及び厚さの比較を行った。表３に、その結果を示す。

【０１１０】

【表３】

	相対的重量	厚さ（mm）
実施例４	0.15	0.5
実施例５	0.17	0.5
実施例６	0.19	0.6
実施例７	0.30	0.5
実施例８	0.34	0.5
実施例９	0.38	0.7
比較例１	0.11	0.7
比較例２	0.10	0.7
比較例３	0.44	1.3
比較例４	1	1.9

【０１１１】表３で、実施例４～９及び比較例１～３の反射型液晶表示装置の重量は、比較例４の反射型液晶表示装置の重量に対する相対値で示されている。表３から明らかなように、実施例１～９の反射型液晶表示装置は、比較例３、４の反射型液晶表示装置に比べて、十分に軽量であることが分かる。また、実施例４～９の反射型液晶表示装置は、比較例１、２の反射型液晶表示装置と同等またはそれ以下の厚さを有しており、比較例３、４の反射型液晶表示装置と比べると大幅に薄型化されていることが分かる。

【０１１２】

【発明の効果】以上示したように、本発明によると、反射型導電性基板が、樹脂により硬化された繊維布からなる積層板上に、白色顔料及び樹脂を含む反射層、シリカからなるバリア層、及び導電層を順次積層することにより構成されるので、軽量で、十分な耐衝撃性、酸素バリア性、水蒸気バリア性、及び耐スクラッチ性を有し、構成が簡単であり、耐熱性及び剛性の高い反射型導電性基板、反射型液晶表示装置、及び反射型導電性基板の製造方法を提供することができる。

【図面の簡単な説明】

【図１】本発明の一実施形態に係る反射型導電性基板の一断面図。

【図２】本発明の他の実施形態に係る反射型導電性基板の一断面図。

【図３】本発明の一実施形態に係る反射型液晶表示装置の一断面図。

【図４】従来の反射型液晶表示装置の一断面図。

【図５】従来の透明樹脂基板の一断面図。

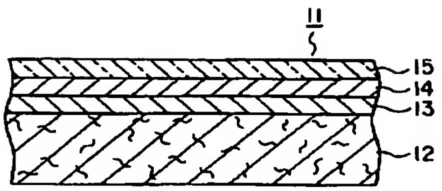
【図６】従来の反射型液晶表示装置の一断面図。

【図７】従来の反射型液晶表示装置の一断面図。

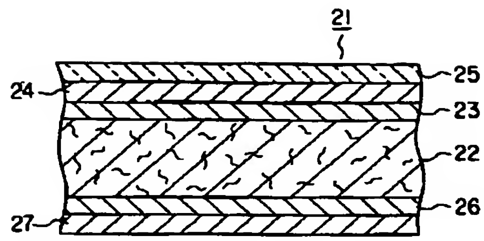
【符号の説明】

１１、２１…反射型導電性基板
１２、２２…積層板
１３、２３、２６…反射層
１４、２４、２７…バリア層
１５、２５…導電層
３１…反射型液晶表示装置
３２…反射型導電性基板
３３…透明樹脂基板
３４…液晶層
４１、６１、７１…反射型液晶表示装置
４２、４３、６２、６３、７２、７３…導電性基板
４４、６４、７４…液晶層
４５、６５、７５…光反射層
５１…導電性基板
５２…耐熱性透明樹脂フィルム
５３…アンカーコート層
５４…透明電極層
５５…バリア層
５６…ハードコート層

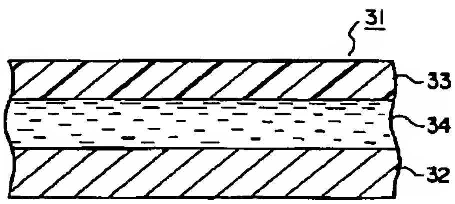
【図1】



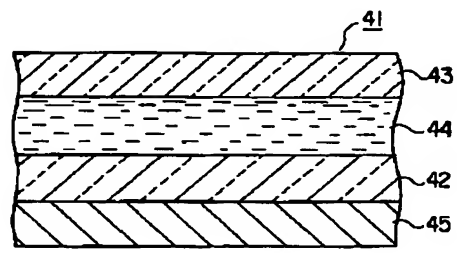
【図2】



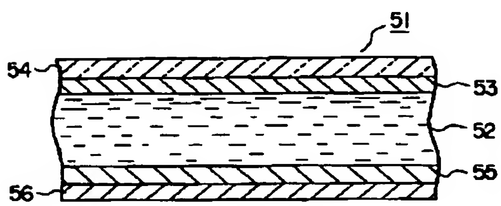
【図3】



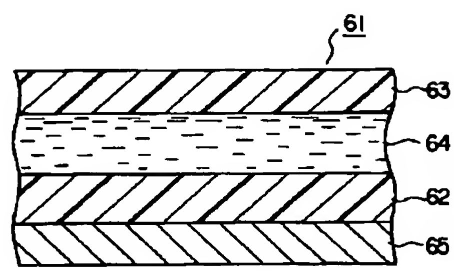
【図4】



【図5】



【図6】



【図7】